

MACHINERY

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Controlling the Quality of 67,000 Different Parts

*Constant Vigilance and an Inspection System of Utmost
Simplicity are Primary Requirements in Controlling the
Accuracy and Quality of Such a Great Variety of Work*

*By C. E. STINES, Chief Inspector
The National Cash Register Co., Dayton, Ohio*

A STRIKING exhibit in the reception room of the National Cash Register Co. is a case containing 7857 parts that go into the assembly of a single register. Other registers have even a larger number of parts and some of them a lesser number. The thousands of parts that go into any one register, however, represent only a small portion of the 67,000 different parts that are constant-

ly carried in stock to meet assembly and service requirements.

The manufacture of such a great variety of parts in large quantities—half a million parts go through the heat-treating department daily, for example—necessitates a large inspection department in order to prevent the production of work that does not meet engineering specifications. One person out of



every fourteen factory employees is an inspector, there being a total of approximately 460 inspectors at the present time. These inspectors function under a system that has been made as simple as possible and which aims toward preventing the manufacture of defective work rather than merely detecting work that fails to meet established quality requirements.

Centralized and Decentralized Inspection are Both Used for Work in Process

Inspectors not only govern every manufacturing and assembling operation, but also check the receipt of all supplies, including raw materials, meat and groceries for the restaurant, stationery, etc. Everything that is made or purchased must meet written specifications. This article will deal, however, only with the inspection system as it applies to parts manufactured in the plant.

Every machine operator is provided with all the gages necessary for him to periodically inspect the work that his machine produces. This periodic inspection of work by the machine operators is definitely considered a part of their job and time is allowed for it in establishing all incentive rates of pay. As far as possible, operators are held responsible for any defective work. Whenever a machine is set up for a different job, the operator must obtain the approval of the job foreman before production can be started.

Inspection of work in process is performed under

a combined centralized and decentralized system, about 75 per cent of the work being transported by conveyors or trucks to one of two centralized inspection departments. After the parts have been inspected, they are dispatched from the centralized inspection departments to the next operation or to stock storage, also by conveyor or truck. The remaining 25 per cent of the work is inspected in the production departments, often on conveyor lines between successive operations.

Inspection Activities in the Two Centralized Departments

Inspection in each centralized department is divided between "floor inspection," which is sometimes called "spot" or "sampling inspection," and "bench inspection." Floor inspectors check a number of pieces out of every tote box coming along the conveyor, while bench inspectors remove the tote boxes from the conveyor line for 100 per cent inspection of their contents. So far as is possible in 100 per cent inspection, the same inspector is assigned to recurring orders of identical parts, this method having been found to speed up inspection activities. The illustration at the beginning of this article shows a general view of the floor inspectors in one of the centralized departments.

Inspection performed on the floor or at a bench is the same as far as actual checking of parts is concerned, the inspection differing only in the manner of handling the work and the percentage

Fig. 1. Bench Inspector Performing 100 Per Cent Inspection of a Register Part by Means of a Special Gaging Fixture



Fig. 2. Dial Gage with an Indexing Plate that Enables the Checking of Different Pieces for Length and Diameter



checked. The equipment consists of the usual run of "go" and "no go" snap and plug gages, contour gages, and indicating gages. When tolerances are especially close, amplifying and optical gages are employed. Many gages are of special design to suit the particular work-pieces, typical gages of this classification being illustrated in Figs. 1, 2 and 3. For extreme amplification and comparison, use is made of a Jones & Lamson optical comparator which is installed in a dark room.

All work coming to a centralized inspection department is routed by stock-handlers over gravity roller conveyors to the inspectors assigned to checking the particular work-pieces. "Right-of-way" and "special right-of-way" work are scheduled for immediate checking and "due date" work is placed on the routine lines.

Each box of work is accompanied by a stock order or travel card, such as seen at the upper left in Fig. 4. This card is referred to by the inspector assigned to the order so that he may obtain the necessary information to enable him to get the instruction card seen at the upper right in Fig. 4 from the departmental files, as well as the proper gages and a blueprint of the work. It is required that the inspector secure all of these items in order that he may properly inspect the particular work-pieces.

The Instruction Card is an Important Feature of This Inspection System

There is an inspection instruction card for every single piece of work that is manufactured in the plant, and each inspector is impressed with the fact that he must consult the proper instruction card for every job assigned to him. He is not permitted at any time to rely on his memory as to what dimensions or peculiar requirements of a part must be checked. Verbal instructions to inspectors are absolutely prohibited. Prior to 1921 the verbal instruction system was a general rule, with the result that defective work frequently passed inspectors, causing excessive costs, delays in assembly departments, and frequent arguments about where to place the responsibility for inspection mistakes.

The weakness of the verbal instruction system led to the adoption of the instruction card system, which necessitated the initial preparation and filing of approximately 38,000 cards. The great amount of work involved and the cost of this installation, as well as the maintenance cost, have, however, been more than offset by the savings that have been realized in the elimination of inspection instructors and the large reduction in the amount of defective parts getting past the inspectors. At the present time there are more than 80,000 instruction cards to cover all items of raw stock purchased, as well as manufactured work. The instruction cards are made out in the inspection department.

Reference to the instruction card at the upper right in Fig. 4 will show that it carries such information as the part name, number, and class; page number of the part in the records of the stock



Fig. 3. Another Inspection Operation in which a Dial Gage of Special Design Provides the Necessary Accuracy

ordering department; blueprint number; routing sequence; gages required and their page number and location; and various data in regard to special points to be watched. Sketches are used to show where parts must be hardened locally, burnished, etc. Sections of parts to be straightened are indicated by lines placed adjacent to the sections. Tolerances for straightness are also shown on these cards.

On the particular card illustrated it is pointed out also that a certain stud is to be checked for tightness, considerable difficulty having been experienced in the past from the looseness of the studs attached to this part. On the back of the card there are columns for writing in the inspector's check number, the number of parts inspected for each order, and the date on which the inspection was made.

With all this vital information regarding an inspection on the instruction card and with the inspector's identification on the back, it is an easy matter to place individual responsibility for passed defective work and all disputes previously caused by lack of information or disagreement about the information given to an inspector, have been eliminated. The use of the inspection instruction cards has also speeded up the checking of work, because it eliminated the necessity of inspectors waiting for an instructor to explain what has to be done on individual jobs and made it unnecessary in many cases to obtain a blueprint for the part that is to be checked.

Whenever sketches appear on inspection instruc-

tion cards, the routing cards of the production department that performs the operations indicated by the sketch, carry a duplicate of the sketch, as well as the same information, so that the production department is informed ahead of time of inspection requirements. This practice promotes greater care in production departments and minimizes work rejections.

The information on the production department cards is also used by the standards department in establishing piece-work rates. It enables fair setting of prices for a standard of work that will meet inspection requirements, and provides information that can be referred to in the event of any disputes arising with regard to the quality of work expected at the time that the piece-work rate was established.

Finally, the value of the instruction card system

to the supervision of the inspection department can hardly be estimated, particularly when changes are made in the supervision personnel.

After the Work Leaves the Inspectors

When the inspector finds an order of parts to be satisfactory, he enters his check number in the proper column of the stock order card at the upper left in Fig. 4 and records the date of the inspection, as well as a symbol for the next operation to be performed on the work. The inspected work is then dispatched on a gravity roller conveyor to the counting scales seen in Fig. 5, where the quantity of passed parts is determined and recorded on the stock order card.

The clerks at the left in the same illustration

Fig. 4. Some of the Forms Used in Controlling Inspection Activities at the National Cash Register Co.

ORDER FOR STOCK

2000

11 / 30

PART AND ORDER NUMBER: E-89179
CARD NO.: 1
DATE OF ORDER: 10-7-37

NAME OF PART: **DETAIL FEED SHIFTING**

SEGMENT "B"

BLUE PRINT NO.: A-39603
PATTERN NO.: 50025 16

QUANTITY ORDERED: 1000
NUMBER PER BOX: 200
NO. OF OPER: 18

OPER. NO.	OPER. NO.	QUAN. ORDERED	DATE	TIME	NO. OF OPER.	DATE	TIME	NO. OF OPER.
159-305f	20010	7	224		26	1	350	30 041
BE9-41 f			10 222		F-XB-15		30	203
375 y			18 209		26	b	350	30 037
121 rz			16 5		VB			
39 1y			24 016					
129 y			30 026					
62 f			11 5 226					
40R-63fz			9 209					
11-7-551z			20 112					
5 1y			26 116					
2 fz			26 206					

PLEASE HANDLE STOCK CAREFULLY

MONTHLY USAGE: 2000
BIN NO.: B-28022

ORIGINAL: _____
CHANGE: _____
INSP: _____
SECTION: _____

2000 DETAIL FEED SHIFTING SEGMENT "B" 89179 5

A-39603 b 7-17-37

59A-305f Depth Gauge - Dr#1
59B-41f Str. & Squaring Block - Assem "C"

375y Research Note of 6-3-37.
121rz 12-29-36 See that large stud is not loose.
391y Test Stud for copper braze.
129y 5-14-37 Check hub with .4375 receiver.
62f
402-63fz
11-7-551z
51y
2fz
26b
VB

9-13-37 Straighten to str. edge (2) ways on the round side and square long stud. (TM).

Carb. & Harden.

THE NCR REOPERATION AND REJECTION TICKET

Mill Dept. 11-30-37

Page No. E-89179 Name of Part. C-2000 Detail
Feed Shifting Segment "B"

350 Pieces out of 350 Inspected

Reason for reoperation: XB-15p
Caused by Burr in teeth from straightening.
(Charge to Assem "C")

Per Cent of Work Returned: 100%

Workman's Name: _____ Check No. 209

Time Allowed: _____ Inspector: 041

Box No. Original Box No. Inspection Dept. G.H. Swaninger Foreman
50025 By Hall
Received the above stock

THE N. C. R. CO. EMPLOYEE'S CHARGE TICKET

Order No. 60305101 P.L. S.A. Job No.

Card Box Letter and No. E-74225 Correct Quantity 1400 Open No. and Letter 35-B Stock Ordering O. K. Stamp

Part Name C-3000 Pawl #4
Ticket Number 10-16 Date Work Finished 10-16

Employee's Name or Group No. _____ Check No. 14102

DEDUCTION-AFTER PARTS PAID FOR

Quantity Paid For	Quantity Accepted	Loss	New Temp. Reg.	Price Per Lot	Amount
1500	1400	100			

DEDUCTION-ERROR IN PIECE WORK PRICE

Correct Price	Wrong Price	Price Per Lot To Be Deducted	Quantity Accepted	Amount

DEDUCTION-ERROR IN HOURLY RATE

Reg. P. W. Spec.	Reg. P. W. Spec.	Rate To Deduct	Hours Worked	Amount

DEDUCTION-ERROR IN HOURS PAID FOR

Hours Paid For	Correct Hours	Hours To Deduct	Reg. P. W. Spec.	Amount

Remarks: (Use Other Side if Necessary) (C) Charge No.

Sup. O. K. Clerk's O. K. Foreman's O. K. Supervisor's O. K. Page O. K. Workman's O. K.

C

F-688 THIS COPY TO STOCK ORDERING-THEN PAYROLL-COST



Fig. 5. The Charging-out Station where the Quantity of Inspected Parts is Determined and Suitable Records Made

then record on a standard register the quantity of parts received; the inspector's number; page, line, and card numbers of the work; the departmental letter; and the operation number of the inspection. A ticket is issued by this register which shows all of this information. On this ticket the clerk enters by hand the departmental and operation numbers of the next operation. This ticket is then forwarded to the stock ordering department for use in maintaining the control records of that department. The records accumulated in the register are used for departmental production control and for compiling weekly rejection reports.

If the quantity of stock is found to be less than the amount called for, a charge ticket, such as shown at the lower right in Fig. 4, is made out by the clerk at the charging-out station and sent to the departments responsible for the last two operations to receive the signatures of the operators who performed this work. This form is then sent to the payroll-cost department and the corresponding amount of money is deducted from the employees' pay.

On the other hand, if the weigher finds that the quantity of parts exceeds the stipulated number, a credit ticket is filled out that is identical to the charge ticket illustrated, with the exception that "increase" and "gain" are substituted on the credit ticket for "deduction" and "loss" which appear on the charge ticket. The credit ticket is also sent to the operators who performed the last two operations for their signatures and then forwarded to

the payroll-cost department, where the proportionate amount of compensation is added to the pay of these operators. Copies of both charge and credit tickets are retained by the operators.

How Work Found to be Defective is Handled

When a floor inspector finds defective work, it is either rejected against the production department responsible or assigned for a higher percentage of checking or sorting by a bench inspector. When a rejection is made by an inspector, the ticket illustrated at the lower left in Fig. 4 is made out in triplicate. The original copy accompanies the bad stock to the production department in which the defect originated, the second copy is sent to the supervisor of that department, and the third copy is retained in the inspection department for use in compiling rejection reports.

All rejected stock, whether it can be salvaged by an additional operation or whether it must be scrapped, is returned to the department responsible for the error so that rejections can be brought to the attention of the operator concerned and necessary corrective steps taken. The percentage of work rejected is marked on the rejection ticket. The good stock is forwarded to the next regular operation.

All rejections made by an inspector must be approved by the inspection foreman before work is returned to the production department concerned. In case the defective work must be scrapped, a

"scrap" ticket must be approved by the foreman of the production department responsible and also by the inspection foreman.

Inspectors have no authority to make any exception to established standards. Exceptions can be authorized only by the inspection foreman and then in most cases only with the approval of the engineering division.

The work of the routine inspection departments is supplemented by an inspection checking section, to which a sample is sent from the first order of any new or improved parts, as well as the gages that have been made for checking the parts. This department must then give its approval of the work dimensions and the gages before production inspection of the part can be started. The inspection checking section also handles all shop and field complaints about individual register parts or assembled units. This section, an important adjunct of the inspection system at the National Cash Register plant, was described in the June number of MACHINERY, page 670.

* * *

Parts Lists that Serve Two Important Functions

By ROGER C. DICKEY

A manufacturing plant engaged in making box machines in which many hundreds of parts are assembled has found that it is necessary for the drafting-room not only to issue drawings for the different parts, but to provide a complete list of parts, which can be used for checking off the finished parts as soon as they are completed. This parts list, therefore, serves to record the progress in producing parts for a machine and assists in having all the parts ready for assembly at the proper time. When the machine has been completed and delivered, the manufacturer files away the parts list, which serves as a permanent record of the machine. This record enables the manufacturer to replace any part of any machine that may be required.

In the case of a very large machine, it has been found advisable to break up the parts list into assembly lists—that is, assembly A, for example, will be applicable to the feed end of the machine; assembly B will cover the folding section, etc. Assembly lists are compiled in the drafting-room. They are typed on tracing paper, 10 inches wide by 14 inches long. Carbon paper is placed in back of the tracing paper so that when the lists are typed, the carbon is transferred to the back of the tracing paper, thus producing a typed list from which good blueprints can be made. The heading of a typical assembly list is shown in the adjacent column.

When an order for a standard machine is received, the drafting-room is instructed to make blueprints of the complete parts lists and issue

them to the manufacturing department. It is not necessary to issue blueprints of the parts, because they have been previously placed on file in the office of the manufacturing department. When a manufacturing department completes an entire assembly, the date of completion is recorded on the parts list, which is forwarded to the assembly department. Then when this department releases the

Model X Automatic Gluer
Assembly A

Check when Completed	Part No.	Description	Number Required	Material
	X-34	Tie bar	3	CRS
	X-35	Support arm	1	CI

assembly, the parts list goes to the shipping room, and in the space provided, the shipper fills in the serial number of the machine, the customer's name and address, the method of shipment, etc. The parts list is then returned to the drafting-room, where it is filed.

This list contains a complete record of all the parts assembled in the particular machine to which it applies. Thus, if the customer should order replacement parts years later, any question regarding the type or design of the particular parts required can be easily answered by referring to the parts list on file.

For special machines, the procedure is somewhat different. As soon as the order is received, the designing department begins its work. When the drawings are ready for the first assembly, the parts list is compiled and issued to the manufacturing department, together with the blueprint drawings of the parts. Work is then begun on that particular assembly. When additional parts lists covering other assemblies are issued, they are added to the first assembly list.

A simple holder for the parts lists consists of two pieces of cardboard, slightly larger than the parts list sheets, two pieces of hard-wood stock, 1/4 inch thick by 1 inch wide, and two 10-24 carriage bolts, 1 inch long, with wing-nuts. The hard-wood pieces are drilled near their ends, and the carriage bolts passed through these holes to form a binder having sufficient space between the bolts for inserting the top ends of the parts list sheets.

This binder provides a convenient means for checking off the parts. It also has the advantage of keeping the parts lists clean and in order. By loosening the wing-nuts, sheets can be easily added. When the parts lists are returned to the drafting-room, the binder is removed and the sheets comprising the list are clipped together for filing.

* * *

The railroads pay in taxes annually an average of \$1400 per mile of line—another reason for the difficulty of the roads to make ends meet.

Calculating Cone Pulley Sizes

By C. A. WIKEN

IN designing cone pulleys for open belt drives, the problem is to so proportion each pair of pulleys or steps that (1) the required ratio will be obtained; and (2) the belt length will be correct for each pair. Graphical methods have often been employed in determining these sizes, but the ac-

Step Sizes for Ratio of 2:

Next determine the radius R_2 and r_2 for a speed ratio N of 2 and a belt length of 118.6 inches. By inserting the known values in Formula (2), we find that $r_2 = 4.054$ inches; and

$$R_2 = 4.054N = 4.054 \times 2 = 8.108 \text{ inches}$$

Formulas Used in Calculating Cone Pulley Sizes

$$L = 2C + \pi (R + r) + \frac{(R - r)^2}{C} \quad (1)$$

$$r = \frac{\pm \sqrt{1.87C^2 (N^2 + 19.112N + 1) + 4CL(N - 1)^2} - \pi C (N + 1)}{2(N - 1)^2} \quad (2)$$

$$C = \frac{L - \pi r (N + 1) \pm \sqrt{1.87r^2 (N^2 + 19.112N + 1) + L^2 - 6.28 Lr (N + 1)}}{4} \quad (3)$$

In these formulas,

L = length of belt (an approximate formula accurate enough to meet practical requirements);

C = distance between pulley centers;

R = pitch radius of larger pulley or step (effective radius to neutral axis of belt);

r = pitch radius of smaller pulley or step; and

N = pulley ratio = $R \div r$; then $R = Nr$

companying formulas can be applied readily in finding the various pulley step sizes required for given ratios and a common belt length.

Design of a Three-Step Cone Pulley

Example—A three-step cone pulley drive is required with speed ratios of 2, 3, and 4. The center distance $C = 40$ inches. The middle pair of steps (see diagram, Fig. 1) has a ratio N of 3; a radius of $R_1 = 9$ inches; and a radius of $r_1 = 3$ inches, as established by the design of the machine.

Determine the required belt length and the radii R , r and R_2 , r_2 of the other pairs of steps.

Belt Length:

By inserting the values $C = 40$, $R_1 = 9$, and $r_1 = 3$ in Formula (1), we find that $L = 118.6$ inches.

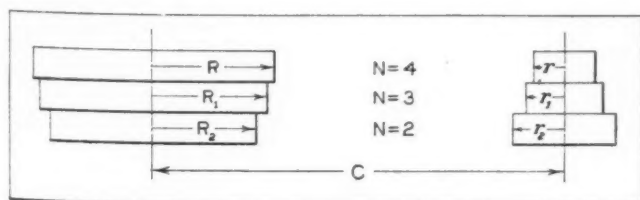


Fig. 1. Diagram of Three-step Cone Pulley Drive to be Designed for Given Ratios and Belt Length

Step Sizes for Ratio of 4:

Again, by inserting in Formula (2) the known values $C = 40$, $N = 4$, and $L = 118.6$, we find that $r = 2.377$ inches; and

$$R = 2.377N = 2.377 \times 4 = 9.508 \text{ inches}$$

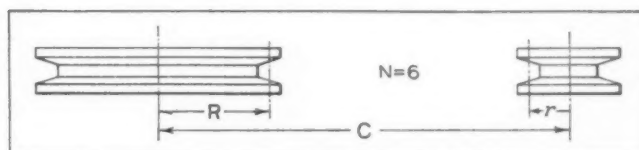


Fig. 2. The Problem is to Find the Pitch Radius of Each V-belt Pulley. The Center Distance C and the Pitch Length of the V-belt are Known

The pitch radius or the dimension to the neutral axis of the belt is obtained by the foregoing calculations. These pitch dimensions are the effective sizes that determine the speed ratio. To obtain the actual radius of any pulley or step, it is common practice to subtract from the calculated pitch radius one-half the thickness of the belt. The neutral axis of the belt, however, is only approximately in the center or at the mid-section. There are differences of opinion regarding the exact location of the neutral axis, and, according to different

rules, the actual pulley radius may equal the pitch radius minus from 0.4 to 0.7 times the thickness of the belt.

Application of Formulas to V-Belt Drives

Example 1—If the pitch length L of an endless V-belt is 81.1 inches, center distance C is 23 inches, and the ratio N is 6, find the pitch radii of the pulleys. (See Fig. 2.)

By substituting these known values in Formula (2), we find that $r = 1.49$ or, say, $1\frac{1}{2}$ inches; hence

$$R = 1\frac{1}{2}N = 1\frac{1}{2} \times 6 = 9$$

Example 2—The stock pulleys supplied by a V-belt manufacturer have pitch diameters of 4 and 16 inches and are to be used with a belt of 81.1 inches pitch length. Find the distance between the centers of the pulleys. From the data given,

$$r = \frac{4}{2} = 2; N = \frac{16}{4} = 4; \text{ and } L = 81.1$$

Substituting these values in Formula (3), we find that $C = 24$ inches almost exactly.

* * *

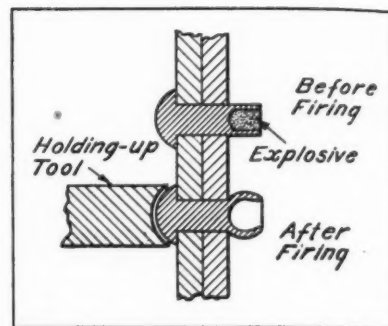
Riveting by Explosion

The British publication *The Aeroplane* mentions an interesting development in riveting which has been put to use by a firm in Europe. The forming of a rivet head on the inside of two sheets to be joined, when the inside is practically inaccessible, is a problem that has occupied the minds of many mechanics. The so-called "draw-through" type of hollow rivet has offered a partial solution, but such rivets have holes through them and hence are not water-tight.

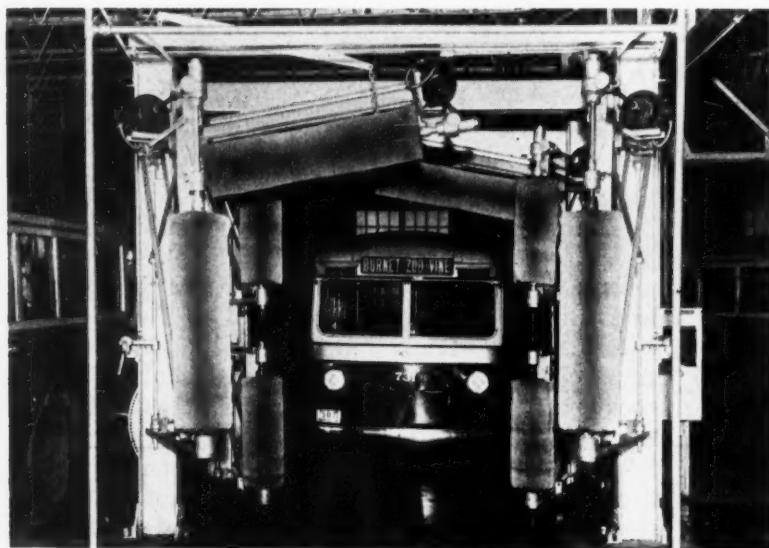
The firm referred to drills a hole in one end of an ordinary steel rivet. This hole is filled with a

specially developed explosive. The rivet is then pushed into the sheets and a hot "holding-up" tool is placed against the head. When the rivet has reached a temperature of 265 degrees F., an explosion takes place. The reaction from the explosion bulges over the sides of the hole into a cup shape, thereby forming a head that has been found to be adequately strong. It is claimed that the method has been so satisfactory that it is used not only for parts where the inside is inaccessible, but also in some cases where it would be possible to rivet in the ordinary way.

Depending on the size of the rivet, the heated "holding-up" tool is held against the rivet from one to five seconds. The tool is electrically heated. To prevent the heat from spreading throughout the part being riveted, the rivets are covered with a coating of Eloxal which has heat-insulating properties. The composition of the explosive has not been disclosed, but it appears to cause no corrosion and to do no harm to the adjacent members in the structure. The rivets are said to provide a fastening means that has 85 per cent of the strength of rivet heads formed in the ordinary way. Presumably the material used for the rivets is also of considerable importance in order that the proper bulging will take place at the moment of expansion due to the explosion, but no information is available on that subject. In fact, there are doubtless many details that have not been disclosed, but the principle involved is interesting.



Diagrammatic Illustration Showing Riveting Done by Explosion



Bus Washed Automatically in Forty Seconds

When the driver of a bus blinks his headlights at an automatic "laundry," an "electric eye" causes water to spray and brushes to revolve, so that in forty seconds the bus is washed free of the dust it has collected on the day's run. The washing machine was installed by the Leeds, Tozzer Co., Inc., in the new garage of the City Transit Co. of Cincinnati. The electrical equipment is Westinghouse throughout, and consists of six two-horsepower, 220-volt, three-phase, 60-cycle, constant-speed splash-proof motors, running at 1750 revolutions per minute.

Longer Life for Centerless Grinder Work-Supporting Blades

By F. R. BONTE and G. A. STUMPF
Steel and Tube Division
The Timken Roller Bearing Co., Canton, Ohio

THE work-supporting blades on centerless grinding machines must be very smooth. The slightest roughness is likely to cause the work to jump or jam, spoiling the product and possibly damaging the wheel. Even when serious results do not occur, a rough spot on the work-supporting blade may scratch the product, causing, before the blade can be replaced, many parts to come off the machine that must subsequently be scrapped.

Until recently, oil-hardening tool steel has been used for such blades in the Timken Roller Bearing Co.'s plant. Some rather expensive hard-faced blades have also been tried. The successful use of Graph-mo steel—a product of the Steel and Tube Division of the Timken Company—in a wide range of punch and die applications in the cage department of the plant, indicated a possible use of this new graphitic steel on centerless grinders. Hence, experimental blades were made for test purposes.

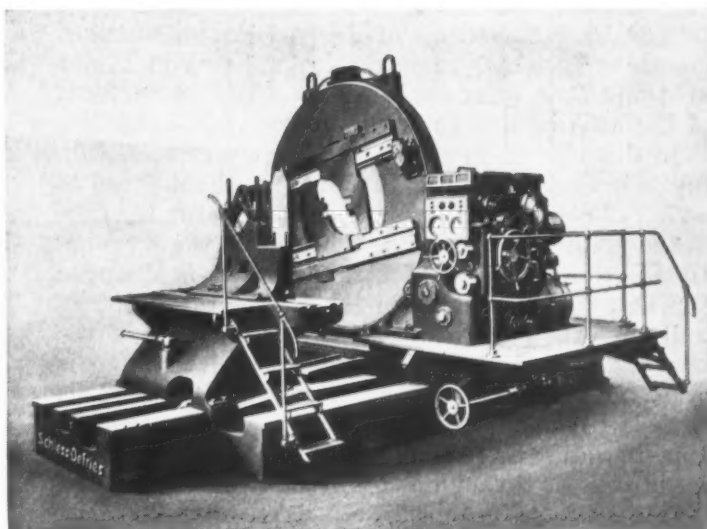
A preliminary investigation indicated that graphitic steel blades lasted longer and that a higher percentage of perfect work was obtained from the machines in which the new blades were used. Ten blades made from the usual oil-hardening tool steel were compared with similar blades made from graphitic steel. The oil-hardening tool steel blades had an average life of 148 hours before regrinding, the minimum being 74 and the maximum 267 hours. Five blades made from Graph-mo

steel used in the same machines and for the same product had an average life of 266 hours, the minimum being 234 and the maximum 303 hours.

The tool-room further reported that the centerless grinder operators quickly noticed the difference in the work-supporting blades and selected a graphitic blade whenever a choice was possible, protesting when such blades were not available. The operators stated that when they used the graphitic steel blades they had no difficulty from the work sticking on the blade as it left the machine, and that the product was free from scratches caused by hard spots in the blade. These statements were substantiated by a close inspection of parts coming from the grinders having graphitic steel work-supporting blades.

Actual hardness is not as important in these blades as is uniformity, because uniform wear may be compensated for by adjustment. Uneven wear, however, will cause a great deal of trouble. Experience indicates that entirely satisfactory results follow when the blades are finish-machined before hardening and finish-ground after tempering. Graph-mo blades are quenched in oil at 1500 degrees F. and tempered at 300 degrees F. for 4 hours per inch of section, to produce a hardness of 64 to 66 Rockwell C. Blades of this type are now replacing the former oil-hardening tool steel blades as rapidly as the stock on hand is being exhausted.

A Crankpin Turning Machine in which the Crankshaft is Held Stationary while the Cutting Tools Rotate about it, Mounted in Holders on a Large Revolving Disk. This Machine was Exhibited by Schiess-Defries A.G., Duesseldorf, Germany, at the Recent Leipzig Fair. Some Unusually Large Models of This Type of Machine are Built. The Largest Size will Handle Crankshafts with Crank Throws up to 63 Inches, and with Shaft Diameters up to 40 Inches. The Bed of the Largest Machine in the Series is Nearly 30 Feet Long by 15 Feet Wide



Atmosphere-Controlled Brazing



Fig. 1. Loading Sheet-metal Parts to be Brazed Together into an Electric Furnace of the Atmosphere-controlled Type, which has a Capacity for 1 1/2 Tons of Work Hourly

The Brazing is Performed in a General Electric Furnace, through which the Work Passes in a Controlled Atmosphere that Prevents Oxidation. The Work is Then Cooled in a Long Water-Jacketed Chamber

LARGE quantities of automobile work are brazed in the plant of the Buick Motor Co., Flint, Mich., in a General Electric atmosphere-controlled, electrically heated furnace that has an hourly output capacity of 1 1/2 tons of work. Parts of wide variety are brazed together in this furnace. The copper wire or powder placed on the parts melts due to the high temperature, flows into the joints to be brazed, and solidifies during the passage of the work through a cooling chamber. The controlled atmosphere prevents oxidation of either the parts being brazed or the brazing material.

Work that has been prepared for brazing is being loaded into the furnace in Fig. 1. This particular work consists of sheet-metal push-rod covers, to each of which a breather unit housing is brazed by the melting of four pieces of straight copper wire which are placed, as shown in Fig. 2 at A and B, in a groove around the joining surfaces of the housing and the cover proper.

In this operation also, a short piece of steel tubing is brazed to the breather unit by the melting of a ring of copper wire which is slipped over the tube to the point where it is to be brazed to the housing. In addition, a piece of straight wire is dropped through the small hole in the top of the breather unit for brazing a baffle plate to the inside of the housing. Copper wire of 14, 16, and 20 gage is used in the various operations performed. This wire is cut off from coiled stock by an automatic machine and then either passed through straightening rolls or through a coiling machine that forms it into rings of required diameters.

This method of using copper wire to effect the brazing of parts is followed extensively, but it is not practical in some cases where flat surfaces of considerable area are to be brazed together and in other instances where wire cannot be made to remain in the proper position on the work. For such operations, copper powder mixed with clear Duco lacquer to form a paste is painted on the surfaces to be joined. This is done as shown in Fig. 3. When

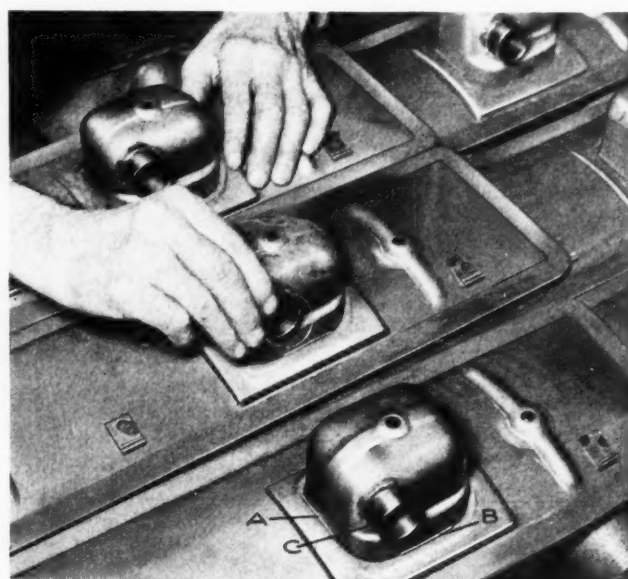


Fig. 2. Straight and Coiled Pieces of Wire are Placed Along Surfaces to be Brazed; They Melt in the Furnace, Flow into the Joints, and Then Solidify

in the Buick Plant

By CHARLES O. HERB

work prepared in this manner passes through the brazing furnace, the lacquer burns off and the copper powder melts to form a strong and tight joint.

The work shown in Fig. 3 consists of radius rods made up of two long stampings that are spot-welded together to facilitate the brazing operation. The mixture of copper powder and lacquer is painted all along the lengthwise edges. Bushings are also brazed in the ends of the radius rods, but this is accomplished by slipping a ring of copper wire around the bushings before they are inserted into the openings of the radius rods. When these wire pieces melt, they flow around the bushings and attach them firmly to the bosses into which they have been inserted.

The work pieces seen in these illustrations are all long enough to be carried automatically through the furnace by the driven roller conveyor with which it is equipped. Smaller work pieces that would fall between the rollers are placed on nickel-chromium trays or racks. In the furnace, the work is conveyed through a long tunnel-like muffle to which prepared gas is supplied. Heat is provided by electrical elements installed in the furnace walls. The heating portion of the furnace is approximately 15 feet long and is maintained at a temperature



Fig. 3. On Certain Work the Surfaces to be Brazed are Painted with a Mixture of Powdered Copper and Duco Lacquer before Placing in the Furnace

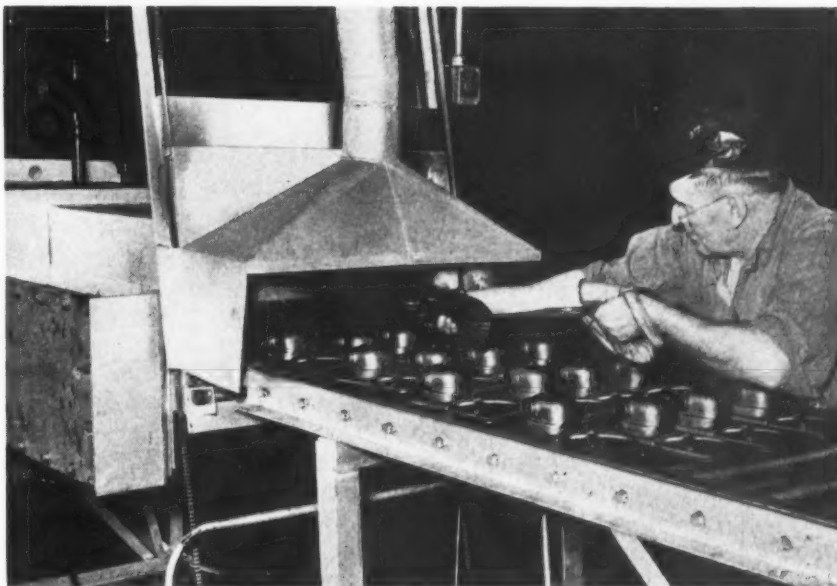


Fig. 4. After the Brazing Operation, the Work Passes through a Long Cooling Chamber to Solidify the Brazing Material and Then Reaches the Discharge End of the Chamber

of approximately 2050 degrees F. for brazing operations.

The gas for the muffle is prepared in a generating unit made by the Selas Co., Philadelphia, Pa., which mixes city gas and air in the proportions of 2 1/2 to 1. The atmosphere supplied to the muffle consists of 20 per cent hydrogen, 12 per cent carbon monoxide, 3 per cent carbon dioxide, and 65 per cent nitrogen. Two thousand cubic feet of gas are prepared by the generator per hour. Curtains of gas prevent the infiltration of air into the muffle when the door is opened at either the charging or discharging end of the furnace.

After the work has passed through the heating section of the furnace, it enters a water-jacketed cooling chamber 55 feet long. The passage through this chamber takes about one hour. When the work is discharged, it is cool enough for convenient handling with hand pads and the brazing metal has completely solidified. The rate of moving the work through the furnace can be regulated by means of the Reeves variable-speed transmission which drives the conveyor.

This furnace equipment is also used to some extent for annealing work in a controlled atmosphere. In annealing operations, however, the furnace is heated to about 1450 degrees F.

* * *

In 1937, Japan imported machinery to a value of about \$46,000,000, an increase of 73 per cent as compared with 1936.

When Does an Inventor Own His Invention?

By A. H. RODRICK

A Review of Legal Decisions Covering the Inventions of
Employes and their Rights versus those of the Employer.
This Article Answers the Question: "Who Owns the Patent?"
when Employee Inventions are Involved

THE question of an employer's right to the inventions of his employes is still a source of much unnecessary industrial litigation. Patent contracts, or rather the lack of them, may add to manufacturing costs, while the actual loss of valuable inventions and the time and money spent in prosecuting or defending lawsuits constitute an obviously greater and more serious waste.

A review of the judicial decisions shows the law to be quite clear and well defined on the subject. Carefulness, therefore, on the part of the employer would eliminate most of the losses and litigation. Three distinct classes of employes are involved in the question of patent ownership—general employes, special employes, and corporation officers.

Patent Rights of General Employes

A general employe is one who is hired without regard to inventive ability. It is definitely settled that, in the absence of an express or implied agreement, the employer, from the mere fact of general employment, has no exclusive rights to the inventions of his employe, even though to perfect his invention, the employe uses his employer's property, receives the assistance of others in the employer's pay, or takes time that should have been given to his employer's business, and even though it can be said that his inventive power was incited by knowledge necessarily derived from his employment. "It matters not how valuable the invention or how vital its control may be for the success of the business in which it has been conceived." [131 N.E. 307] As said by the Court in the case of *Dice v. Joliet Mfg. Co.* [11 Ill. A. 109]: "An invention is the product of the mind. As between employer and employe, the right to the invention belongs to the one who conceives the idea and follows it out to practical invention."

Necessity for Valid Agreement

If the employer desires to have a right to the inventions of a general employe, made during the term of the employment, he must enter into a pre-employment or subsequent agreement with the employe to that effect. The employment itself;

continuance of employment; wages; confidential position occupied; or any other like prerequisite is a sufficient valuable consideration for the covenant. Such agreements are not contrary to public policy, and are, therefore, enforceable. [148 Fed. 209] They will, however, be strictly construed as against the employer for, as has been said, "the law inclines so strongly to the rule that the invention shall be the property of its inventor that nothing short of a clear and specific contract to that effect will vest the property of the invention in the employer to the exclusion of the inventor." [105 Ill. 649]

Scope of Agreements Covering Rights to Patents

Agreements referring in express terms or by implication to inventions or improvements connected with a limited class of machines, while enforceable so far as that class is concerned, have been held not to apply to inventions of another kind not named or implied in the contract, nor to inventions connected with machines generally which are used in that particular trade. For example, an employment contract provided that the employer should have the full benefit and enjoyment of any and all inventions or improvements that the employe had made or might make relating to machines or devices pertaining to the employer's business. The employe for three years was kept at work on machines regulating the size of candy after it was whitened. The Court held that the contract referred to that kind of machines exclusively, and did not cover the employe's invention of a machine designed to whiten the candy. [148 Fed. 676] On the other hand, it has been held that, if the agreement is not restricted to inventions along a particular line, but covers all inventions made by the employe during the term of employment, the employer has an equitable title in all his employe's inventions made during the term, even though the employe worked on them out of business hours. [115 N.W. 988]

If the employer under a license, express or implied, uses his employe's invention, there is an implied promise on his part to pay the employe for its

use, independently of, and in addition to, the amount due under the employment contract as wages [44 N.E. 322], unless the employee has given his employer in express terms the free use of his invention [150 U.S. 224] or by his conduct has indicated his acquiescence in its use without payment therefor. [160 U.S. 426, 150 U.S. 193, 80 Fed. 906, 198 N.W. 146]

A contract providing for the assignment of the employee's inventions to his employer will not be enforced where the employer is himself in default. For example, where the employer, during the entire period of perfecting the invention and filing of an application for patent fails to pay the employee his salary, the employer is not entitled to an assignment of the patent to him under a contract so providing. [300 Fed. 866]

Employer May Have a "Shop Right"

A "shop right" is an indirect contract relationship of employment that pledges the inventor to give the manufacturer the right to use the invention in his shop. The latter, however, has no right to use the invention anywhere except in his own shop. Such a right is, therefore, merely personal. It is neither transferable nor assignable, and continues as long as the employer remains in business, even though the employee-inventor has left his service. It is so limited, however, that if the employer moves away or sells that shop, he cannot take the right to use the patent with him. When he ceases operations, the invention remains with the employee, and should the employer become bankrupt, the "shop right" would not pass along with a sale of the assets.

Although an employer, in the absence of an agreement, has no exclusive rights to the inventions of his general employees, he may be entitled to a "shop right" for the use of them, for it is well settled that "by express agreement, or by implication from the circumstances of the employment, more generally from evidence disclosing an employment without formal agreement, a use by the employee of his employer's property and the services of his co-employees, and an assent by the employee to the employer's use of the invention, may confer upon the employer a license or 'shop right' for the use of the invention."

In the leading case of *Solomons v. U.S.* [137 U.S. 342], the Supreme Court of the United States said: "When one is in the employ of another in a certain line of work and devises an improved method or instrument for doing that work, using the property of his employer and the services of other employees to develop his invention and put it in practicable form, and explicitly assents to the use by his employer of such invention, a jury or a court trying the facts is warranted in finding that he has so far recognized the obligations of service flowing from his employment and the benefits resulting from his use of the property and the assistance of his co-employees as to have given to such employer an irrevocable license to use such invention."

For example, under an agreement by an employee to use the employer's plant and products in order to develop new products and processes for the employer's benefit, it was held that the employer does not take title to the employee's inventions, but has merely a "shop right" to use them [5 NYS 190]; and an employee's superintendence of the construction of buildings on his employer's premises in which to place the machinery invented by him and to be used by his employer was held sufficient to raise a presumption of the grant of a license to the employer to use the machinery so long as he continued in the business. [129 Fed. 370]

The employment does not, of itself, imply any license to use. For example, should the employee perfect his invention out of business hours and in a place other than his employer's plant, the employer cannot base any claim to a right to use the invention on the mere fact of employment. [109 Atl. 685]

If the right of the employer under a shop license is extended by its terms to his exclusive use, the employee cannot make a valid assignment of the patent to the employer's competitor. [65 Fed. 864]

Patent Rights of Special Employees

A special employee is one who is hired because of his inventive ability and who is under contract to use such mechanical capacity in making improvements or developing new processes of either a general or a special nature.

It is definitely settled that, where one is employed in experimental work to secure certain defined results, the employer has an equitable title, as against his employee, to the particular inventions the latter was hired to perfect. This was held to be the law in the leading case of *Standard Parts Co. v. Peck*. [264 U.S. 52] As said by the Court in the case of *Connelly Mfg. Co. v. Wattles* [23 Atl. 123]: "A man may sell the conceptions and productions of his mind. He has the same right to agree to work for another, with his brains that he has to agree to labor for him with his hands. In employments where skill or art is required, the most valuable service which, as a general rule, the employee renders to his employer is by the exercise of his mental faculties."

"The doctrine is settled that where one person agrees to invent for another, or to exercise his inventive ability for the benefit of another, the inventions made and patents procured during the time of service covered by the contract belong in equity to the employer and not to the employee." In other words, that which the employee was employed for and paid to accomplish becomes, when accomplished, the property of his employer. [137 U.S. 342] In the case of *Air Reduction Co., Inc. v. Walker* [195 NYS 120], a man was employed as a research chemist to discover a method for utilizing commercially a gas. He discovered a method, for which he secured a patent; but his employer was held to be entitled to an assignment of the patent, instead of a "shop right" to use it.

Inventions Made After Employment

An employee's inventions made before or after he has left his employment belong to him, in the absence of any contract stipulation to the contrary. An express provision of a contract of employment may cover inventions made after the term of the employment, and where the circumstances give rise to an equitable title in the employer to such inventions, the fact that the patent is issued or application therefor is filed after the employee has left his employment is not material. [2 Fed. (2d) 4] For example, an inventor entering employment under a contract for one year agreed to assign to his employer all inventions made by him "during one year following the termination of employment." He continued in the employment beyond the first year he contracted for, and later left. The invention was made within one year after he left, but more than one year after the end of the first year contracted for. The contract was construed as covering inventions made within one year after his actual leaving of his employer. [202 NYS 691] On the other hand, a contract by an employee to assign his inventions to his employer "while in his employ" will not be allowed to operate as an assignment of inventions made after the expiration of the contract term. [133 Mass. 443]

Patent Rights of Corporation Officers

The fact that the employee holds an important office in the corporation that employs him has been held under the circumstances in some cases to establish a trust relation, making it inequitable for him to retain the title to an invention which really belongs to his employer. For example, an invention that is worked out by many employees of the company and is vital to the future success of the company cannot be held to be the individual property of the president. A patent applied for and issued in his name is held by him in trust for the company. [254 Fed. 308] But the holding of such a position, however, is not conclusive, and if an employee under the circumstances of the case is entitled to ownership of his invention, as against the corporation that employs him, the mere fact that he is one of its officers will not operate to defeat the title.

Employer's Rights Summarized

1. An employer is not entitled to the inventions of his general employees without an express agreement, even though the employee used the employer's property to perfect the invention.
2. An employer is entitled to the inventions of his general employees if the employee enters into such an agreement.
3. An employer is entitled to a "shop right" to use the inventions of his general employees if the employee used the employer's property to perfect the invention and assented to the employer's use of it. Such a right is confined to the employer's own shop; it cannot be taken with him if he sells the

shop or moves away; is irrevocable, because it continues as long as he remains in business; and cannot be transferred or assigned.

4. An employer is entitled to the inventions of his special employees.

5. An employer is entitled to the inventions of his general and special employees made after the termination of their services if the employee enters into such an agreement.

* * *

One-Hundredth Horsepower Electric Locomotive Motors

Miniature railway enthusiasts are a very particular group of people. They want the locomotives and rolling stock that they construct to be faithful reproductions of actual railroad equipment. Until recently there has been no electric motor available which would give a pulling power proportionate to that of actual electric locomotives, and still meet the dimensional requirements of the model builder.

The problem has now been solved by Gordon Varney, Hollywood, Calif., who manufactures scale model trains—not toys, but miniature equipment for adult railroad enthusiasts. He has constructed an electric motor that has the qualities of a full-sized motor, except that its dimensions are proportionately smaller. The motor makes use of a permanent magnet made of Alnico, a nickel-aluminum-cobalt alloy manufactured and patented by the General Electric Co. The permanence of magnets made from this alloy makes them ideally suitable for applications such as this. For example, other applications might possibly be made to products requiring compact design, such as dental tools. The Varney motor is only 2 1/2 inches long from the end of the shaft to the heel of the magnet. It weighs 2 1/2 ounces and develops 1/100 horsepower.

* * *

Proposed Standard for Malleable-Iron Screwed Fittings

A proposed revision of the Tentative American Standard for Malleable-Iron Screwed Fittings has recently been completed by the joint committee of the American Society of Mechanical Engineers, the Manufacturers Standardization Society of the Valve and Fittings Industry, and the Heating, Piping and Air Conditioning Contractors National Association, that has this work in hand. The revision not only includes up-to-date information on malleable-iron screwed fittings, but also incorporates specifications for lock-nuts and bushings, as well as the material on pipe plugs previously published in the American Standard for Pipe Plugs. This proposed revision is now being distributed to industry for criticism and comment. Copies are available on application to C. B. LePage, assistant secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

Beading, Tapering, Flanging, and Heading Tubing on a Riveting Machine

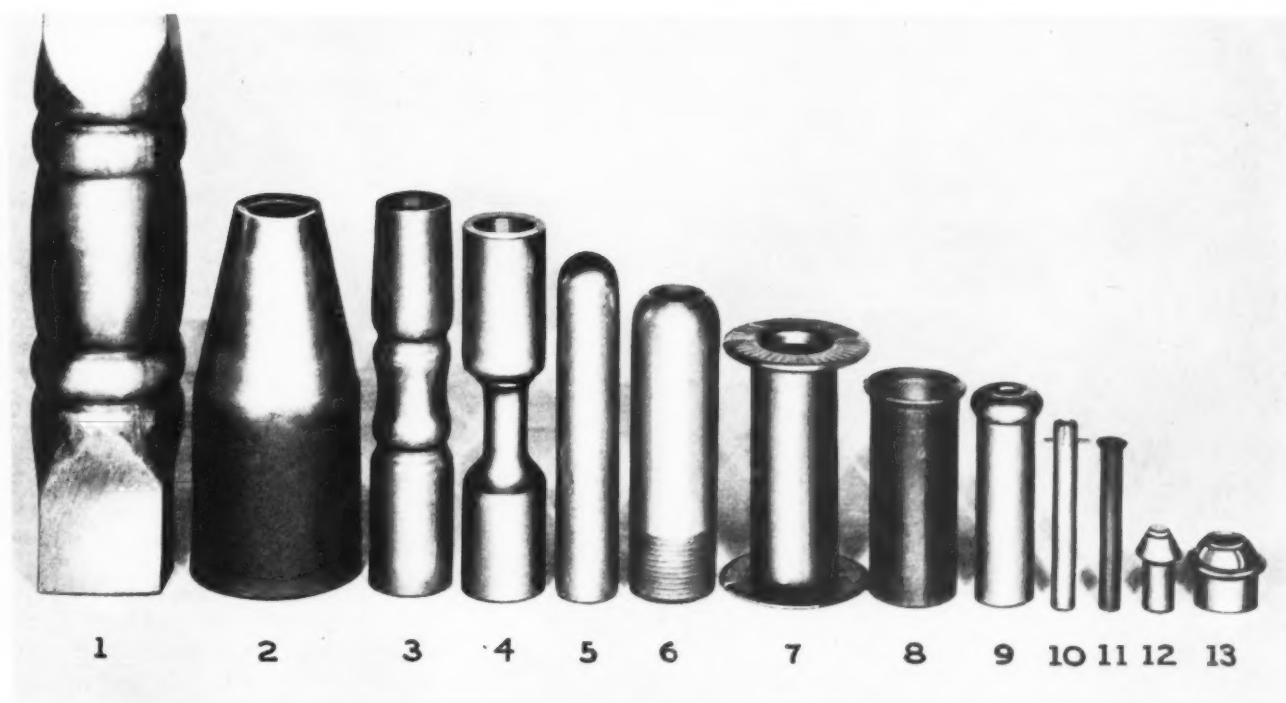
THE accompanying illustration shows thirteen different samples of tubing on which various operations have been performed simply by the application of a riveting machine—the high-speed riveting hammer made by the High Speed Hammer Co., Rochester, N. Y. All the operations were performed cold and in most cases the work was held in a vertical position; but beading and tapering operations must, as a rule, be performed in a horizontal position. When the tube is held in a horizontal position, the thrust of the pein is partially absorbed by the end of the tube.

An exception, however, is that of the heading operation performed on the Diesel engine fuel injector tube (12). Since the tubing from which this part is made may come in many different lengths, it is necessary that it be held entirely by its outside diameter, without any support at the end. This is made possible by the fact that the wall thickness is relatively heavy. A polished surface is desired on the tapered portion of the head. This is produced by the burnishing action of the power-rotated pein as it hammers the head to shape. The actual heading time on this injector tube is from one to three seconds. The operation is far less costly than would be the welding on of a head to the tubing.

Operations of this kind performed on tubing are possible without cracking because of the resilient action of this type of riveting machine. The length

of the stroke is not positive as in a power press. The downward travel of the ram is limited by the amount of material that is displaced at each stroke and it progresses downward only as the work takes the shape of the pein. As in riveting, the peins for this type of work are equipped with two, four, or more prongs—thus working upon a relatively small area of the metal at each stroke.

Samples (8) and (11) show simple angular flanging; sample (7) shows double-end flanging at right angles to the tubing; samples (5) and (6) show the end of the tubing closed in. It is possible to practically close the hole, as shown in sample (5). The end hole in sample (6) may be drilled and tapped, making a reduction from one size pipe to another possible without a fitting. Samples (9) and (13) show how the hole in the tubing may be closed in at the same time as the tubing is flanged outward. Sample (10) shows how projections may be produced on tubing that is to be surrounded by plastic material, thus holding the plastic part securely to the tubing. Sample (2) shows a simple case of tapering a steel tube that measures 2 inches in diameter and has a wall $\frac{7}{64}$ inch thick. Samples (1) and (3) show examples of different types of beading, while sample (4) illustrates how 1-inch steel tubing with a $\frac{5}{64}$ -inch wall can be reduced to $\frac{33}{64}$ inch outside diameter. Every sample of tubing shown in the illustration is made from steel except sample (13), which is made from brass.



Samples of Tubing that have been Formed, Beaded, Flanged, or Headed on a Riveting Machine

Engineering News Flashes

The World Over

A Timepiece of Remarkable Accuracy

In the annual report of the National Physical Laboratory of Great Britain, it is mentioned that a new type of clock has been devised and constructed by the electrical department of the laboratory, which is of such remarkable accuracy that it will gain or lose only a fraction of a second a year. Such a clock is being constructed for use at the Royal Observatory at Greenwich, England.

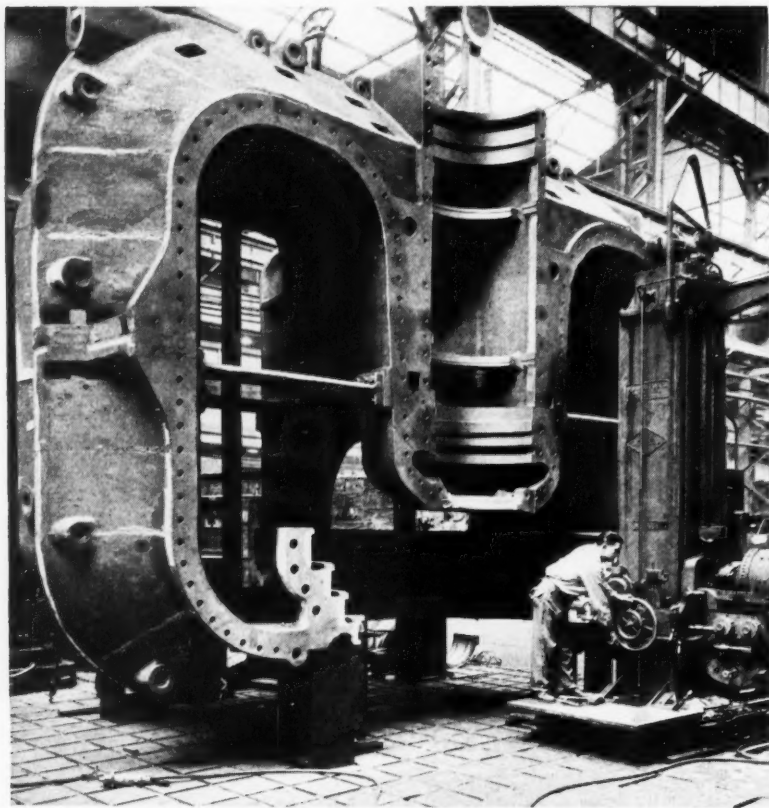
New Cobalt-Nickel Plating Method

At the recent Savannah meeting of the Electrochemical Society, Dr. Louis Weisberg, president and consulting chemist of Louis Weisberg, Inc., New York City, read a paper on the commercial electro-deposition of cobalt-nickel alloys. Plating with these alloys has attained significant commercial importance within a little more than two years, as a result of the discovery that the presence of sodium formate and formaldehyde in the sulphate bath renders it easy to obtain bright deposits of

the alloy without polishing or buffing after plating. The deposits are ductile and can be bent or twisted without peeling. Brittleness, when it occurs, is due to the presence of impurities. Methods for eliminating these impurities have been developed. Cobalt-nickel deposits are chiefly used in place of nickel as an undercoating for chromium. They are also used as undercoatings for silver and gold. Sometimes they are employed without any overplating. Objects plated with the alloy have a blue-white color.

Electrical Equipment Keeps Going Over Fifty Years

An interesting record of long service was recently revealed when an old incandescent dynamo was returned to the General Electric Co. for overhauling. In looking up the records, it was found that the dynamo was built in the Thomson-Houston plant at Lynn, Mass., in 1886. According to the Bell Shoe Co. of Beverly, Mass., the present owner,



Sometimes it is Easier to Bring the Machine to the Work than the Work to the Machine. That is the Case in Machining the Casting Shown in the Illustration, which is the Lower Half of the Exhaust Hood of a Large Turbine under Construction at the Schenectady Works of the General Electric Co. Here a "Portable" Drilling Machine has been Moved into Position for the Drilling of Flange Holes in the Casting

One of the More Unusual Hardness Testing Machines Exhibited at the Recent Leipzig Fair was the So-called "Briviskop," Made by Georg Reicherter, Esslingen a.N, Germany. This Hardness Testing Machine is Applicable to Either Brinell or Vickers Tests. It is Shown Here Equipped for Testing the Hardness of Gear Teeth

the machine has given efficient service throughout the fifty-two years that it has been operating. The dynamo, which is rated at 112 volts, 1250 R.P.M., is used to generate power for lighting the factory.

Galvanized Sheet Iron, an Ideal Surface for Oil Paintings

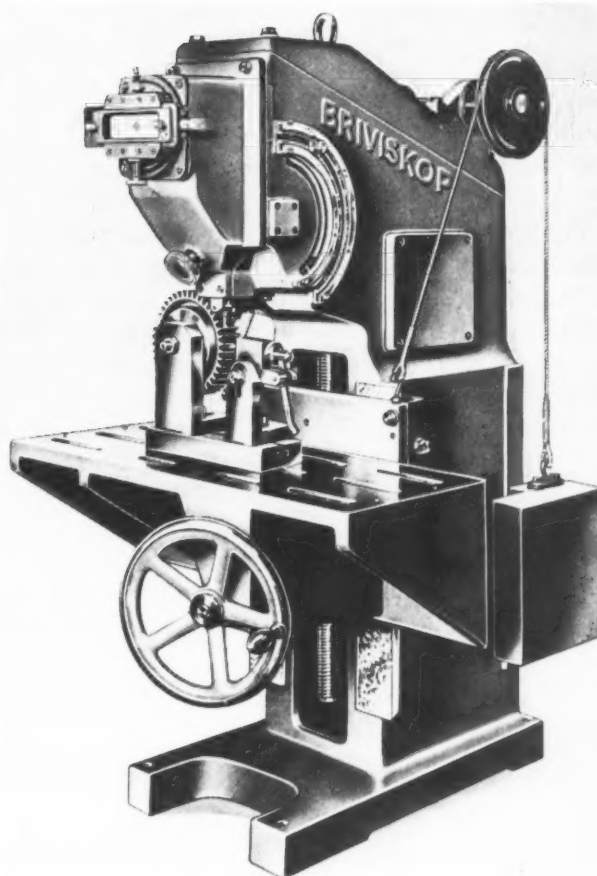
The new galvanized sheet metal known as "Paint-grip," made by the American Rolling Mill Co., Middletown, Ohio, is said to present an ideal surface for oil paintings. In fact, it is claimed to be the first material in art history that promises complete perpetuation to the work of landscape and portrait artists. It is said that the finished work is unaffected by sulphur and other atmospheric elements that ordinarily attack paintings. It is moisture-proof, and does not set up chemical reactions harmful to pigment or vehicle; the slight expansion and contraction of the metal will not crack hard paint. In addition, it is said that a less binding vehicle is required for the paint, and, as a consequence, the colors possess great richness and brilliancy. When the picture is thoroughly waxed, it is believed that it may be preserved indefinitely.

Glycerine as a Lubricant

In the processing and pumping of gasoline, where oil lubricants have been found to dissolve very quickly, glycerine has been found especially useful either as a lubricant in itself, or as a constituent in other lubricants. Other applications of the successful use of glycerine as a lubricant are found in shaft lubrication in collieries, for pistons of air compressors, in mechanical refrigeration, and in delicate machinery and clock mechanisms. It is also frequently used in canning machinery to lubricate the rubber rings used in packing, since other lubricants obviously would not be permissible.

Reducing the Dead Weight and Increasing the Pay Load of Freight Cars

The Ryan Car Co., South Chicago, Ill., has adopted the welding process in building the underframes of 2600 freight cars for the Union Pacific Railroad. The welding process, in conjunction with the use of improved steel, has made it possible to build a stronger frame, although it weighs 1400



pounds less than similar frames formerly used. General Electric welding equipment is being used in the fabrication process.

Using Cotton in Road-Building

Cotton fabric woven with a coarse mesh is being used in Lancashire, England, as a road-building material. Concrete is first laid in the usual way to a depth of 5 inches. Then the coarse cotton fabric, which looks somewhat like a fish-net, is placed on top of the concrete, separating the foundation layer from the concrete surface layer, which is 3 inches thick. When resurfacing is necessary, the top layer can be removed without disturbing the bottom layer. The cost of the cotton material is said to be about 4 cents a square yard.

Per Capita Production of Synthetic Plastics

According to figures given in a paper presented before the Midlands Section of the Society of Chemical Industry at Birmingham, England, the production of plastic materials in proportion to population leads in Germany, followed by the United States and Great Britain. According to the figures given, the production per capita is 1.5 pounds in Germany annually, 1.45 pounds in the United States, and 1.09 pounds in Great Britain.

EDITORIAL COMMENT

The president of a very large manufacturing organization, whose products are well known throughout the nation, writes us as follows:

"To me, the most serious thing facing all industry today is the belief on the part of organized labor that hurting industry is helpful to labor. In practically every plant organized under the C.I.O. one finds the attitude of the unions completely destructive. We have tried to tell the representatives of our employees that anything that can be done to increase efficiency and reduce the price of our product to the buying public is helpful to the employees of this institution. However, at the present time, that doesn't seem to register; and instead of getting cooperation, we are getting the opposite."

Very little comment seems necessary. It ought to be obvious that, since the very foundation of national well-being is industrial activity and prosper-

Whatever Hurts Industry Hurts Labor.

perity, whatever hurts industry hurts every worker in industry; whatever benefits industry reacts favorably upon the workers in industry. An active and prosperous industry is able to provide steady employment at good wages. It is also able to reduce prices, so that the goods that the worker consumes can be bought more cheaply.

On the other hand, when industry is harassed by strikes and the imposition of regulations that hamper efficiency and prevent production at reasonable costs, prices must go up. As prices go up, sales are reduced, because a constantly smaller number of people can afford to buy at the higher prices. When a company cannot sell its products, it obviously cannot continue to manufacture them; it must reduce the number of people employed and the number of working hours. In other words, the earnings of labor are reduced, even if the hourly rate of those who remain employed is not changed.

Of late, a very large group of the workers in the country has been unfortunate in having wrong leadership—leaders that have advocated strife and opposition instead of conciliation and cooperation. The inevitable result is now in evidence in most fields, and the workers are the first to suffer.

If there were cooperation instead of strife, all concerned would be better off. The declaration of the American Federation of Labor, as published in July MACHINERY, page 775, expresses the willingness of the Federation to cooperate with industry

in creating a better understanding between labor unions and industry. If this declaration is followed by definite action, and if industry reciprocates in accepting the Federation's offer, there is hope for a new era in the history of labor relations.

The Machinery and Allied Products Institute emphasizes that America's progress is closely linked with the free development and use of inven-

Relation of Inventions to a High Standard of Living

tions in its industries and in agriculture. The state of Michigan, where aggressiveness in developing new inventions and instituting mechanical improvements is probably greater than in any other state in the union, we find the highest weekly factory wage in the United States, as based upon the reports of the Department of Commerce. Mississippi has the lowest per capita income in the nation; it is also at the end of the list in the percentage of farms equipped with tractors, and almost at the bottom of the list in per capita horsepower consumed by its industries. The more machinery a state or nation uses, the higher are the wages it pays—that is, the higher is the standard of living.

In many plants, the foreman is burdened with so much work pertaining to order chasing and production record routine that he has little time left to perform the

How Much Clerical Work Should Foremen be Required to Do?

most important part of a foreman's duties—that of supervising the mechanical work, instructing his men, and acting as a general leader of his department.

Many large companies have recently recognized the inadvisability of requiring that the foreman should spend a large part of his time on the duties of a production clerk. They have reorganized their systems with the view of giving the foreman more time for the important work of supervision. It is too expensive to let a good foreman spend his time on clerical work. More and more of the foreman's time need be given to training new men and devising better methods.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers
as Typical Examples Applicable in the Construction of
Automatic Machines and Other Devices

Mechanism for Ejecting Formed Part from Dovetail-Shaped Punch

By L. KASPER

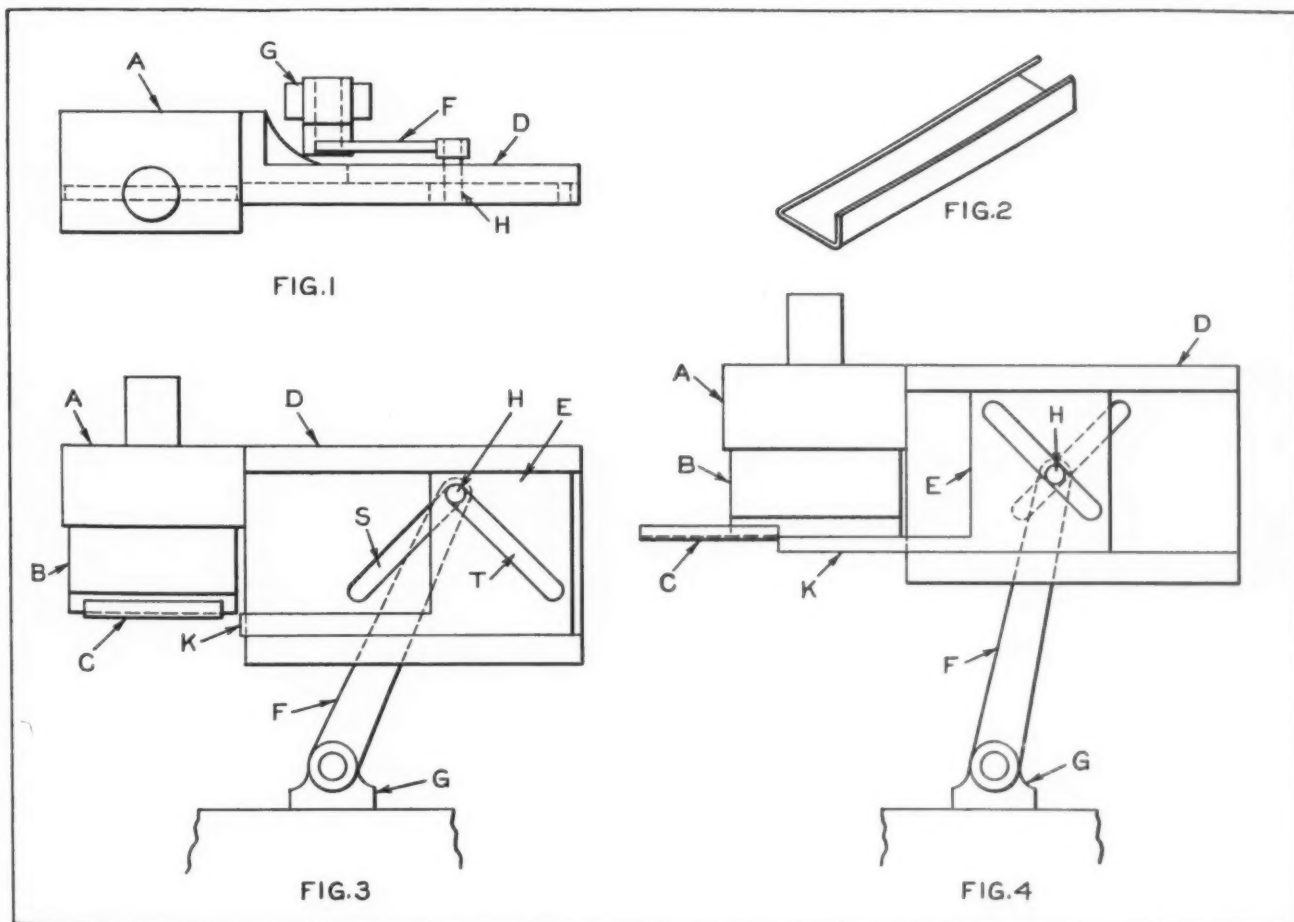
In producing the piece shown in Fig. 2 on a punch press, it is necessary to strip the work from the forming punch. Although operations of this type are not unusual, this particular operation presented some difficulty because the work was 4 inches long, and the stroke of the press only 2 1/2 inches. As it appeared inadvisable to attempt to strip the work from the punch by a direct leverage arrangement under such conditions, the stroke-multiplying mechanism shown was devised.

Referring to the illustration Fig. 3, the punch *B* is carried in the holder *A*; the die, being of conventional design, is not shown. Punch *A* carries

the grooved bracket *D* in which the ejector *E* slides freely in dovetailed ways. The extension *K* on the forward end of the ejector passes directly under punch *B* in removing work *C* on the up stroke.

A slot *S* is machined in bracket *D* at an angle of 45 degrees with the horizontal. Slide *E* likewise has a 45-degree slot *T*, which is inclined in the reverse direction. Block *G*, fastened to the bolster plate of the press, provides a bearing for the oscillating lever *F*, which carries the pin *H* at its upper end. Pin *H* passes through the slots in both *D* and *E* at the point of their intersection. In Fig. 3 the ram of the press is shown at its lowest point, while slide *E* is held at its extreme rear position. Fig. 1 is a plan view of Fig. 3.

In Fig. 4, the ram is shown as it appears after having completed more than half of its upward stroke. As the ram ascends, pin *H* approaches the



Mechanism by which Vertical Stroke of Punch Produces a Horizontal Movement of Stripper
Equal to Twice the Length of the Punch Stroke

bottom of the slot in bracket *D*, causing lever *F* to swing forward. As pin *H* passes through the slot in slide *E*, the latter member is carried forward, but because of the angularity of the slot in slide *E*, its movement is twice as great as that of the pin *H*. Thus the vertical movement of the ram is transmitted through slide *E* in a horizontal direction and at an increased ratio sufficient to strip work *C* from punch *B*.

Spring-Winding Mechanism for Automobile Signalling Lights

By CHARLES R. ENGEL

Some time ago the writer developed a switch for controlling automobile signalling lights which contains a clock movement. The movement is started by winding up a clock spring each time the control handle is turned. Turning the handle to the right lights the green signal, indicating a right-hand turn. Turning the handle to the left lights the red signal, indicating a left-hand turn. Turning the handle in either direction must always wind the clock spring in a clockwise direction. The problem of finding a movement which would do the winding under these conditions was solved by the mechanism shown in the accompanying illustration.

This mechanism serves to wind the spring regardless of which way the handle is turned. The leverage and the pressure are the same for movement in either direction. The distance the handle travels is also the same in each case.

Referring to the illustration, the spring to be wound is attached to segment gear *A*. Swinging the handle *B* to the position indicated by the dotted lines at *C* turns on the red light and rotates segment gear *A* in a clockwise direction through an angle of 60 degrees. This movement serves to wind the clock spring in a clockwise direction. Rotational movement is imparted to gear *A* by handle *B* through contact of the arm *D* with the projecting member *E*.

Swinging handle *B* to the right, into the position indicated by the dotted lines at *F*, serves to light the green light and also rotate the segment gear *A* through an angle of 60 degrees in a clockwise direction. In this case, however, rotational movement of gear *A* is transmitted from handle *B* through the segment gear *G* by contact of the projecting member *H* on handle *B* with the projecting member *J* on the segment gear *G*. The design of segment gear *A* is shown by the views to the left. Lever *B* is also shown in a separate view to the right.

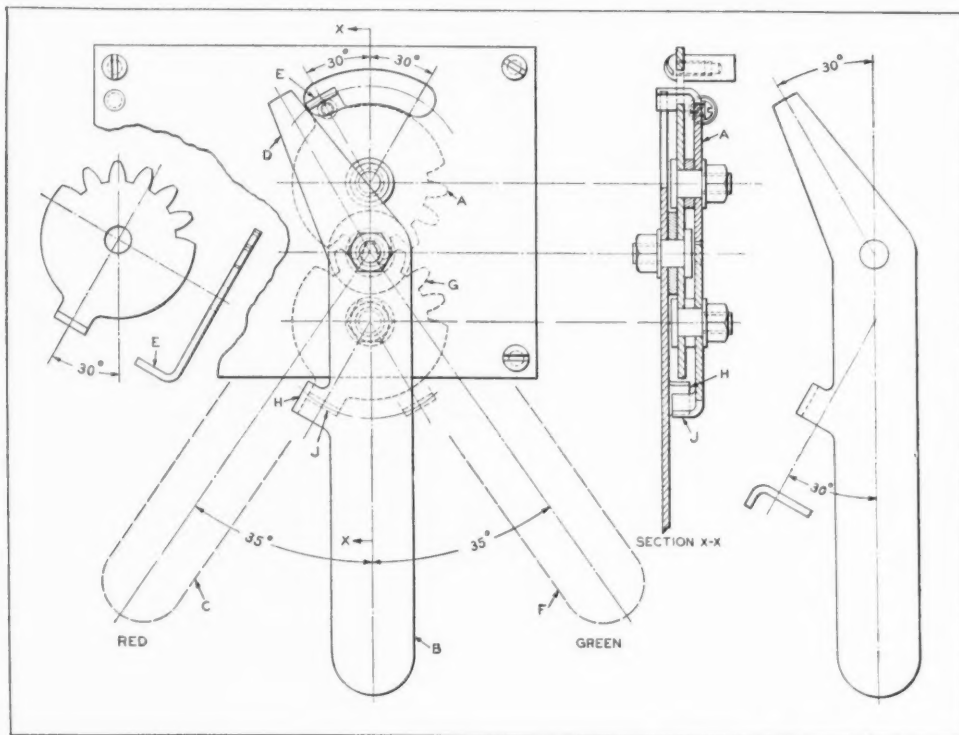
Straight-Line Mechanism for Disk Saw

By PAUL GRODZINSKI

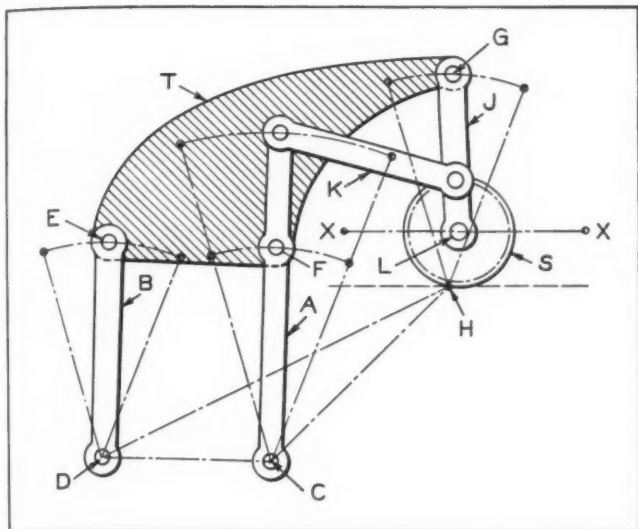
A mechanism consisting primarily of a link suspension frame for the rotating spindle of a saw for wood and similar materials is shown in the accompanying illustration. The interesting feature of this arrangement, which restricts the hand feeding movement to a horizontal motion along the straight line *X-X*, is the large amount of space it

allows between the saw *S* and the supporting links *A*. There are two supporting links *A* and two links *B*. These four links are mounted on bearing studs on the base at *C* and *D*. This arrangement permits links *A* and *B* to swing through the arcs indicated by the dot-and-dash lines.

The connecting bar *T* is triangular in shape. Triangles *E*, *F*, *G*, and *D*, *C*, *H*, are equal and are located in corresponding parallel positions. Link *J* is connected to *T* at *G* and to a rod *K* which is attached to the extension of link *A*. Thus the end *L* of lever *J* which supports the rotating saw *S* has a nearly straight-line motion. When member *J* is moved by hand, the saw *S* is given a straight-



Mechanism for Rotating Segment Gear in One Direction Regardless of the Direction in which the Operating Lever is Moved



Mechanism for Guiding Saw S along Straight Line X-X

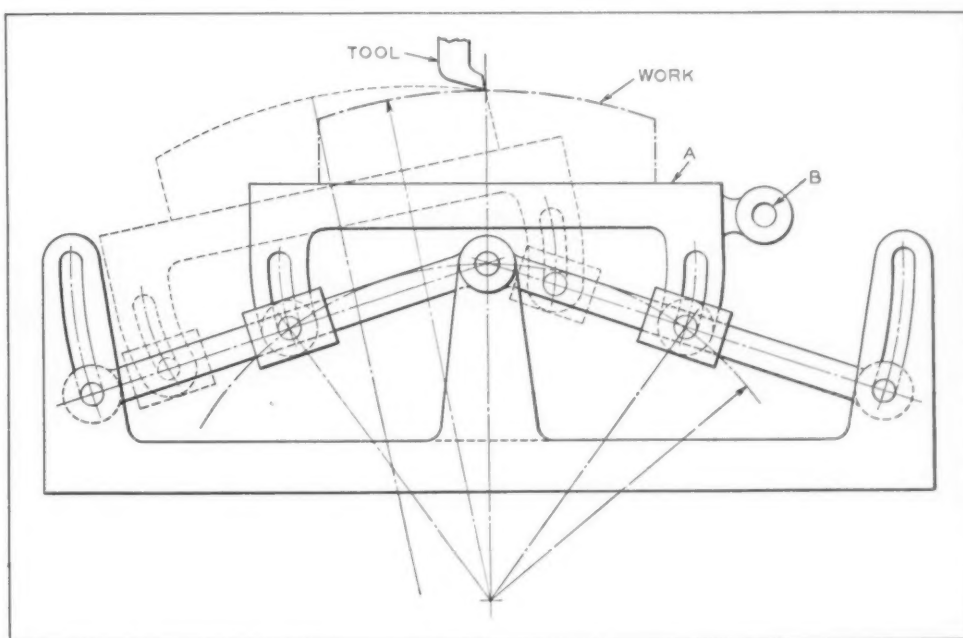
line motion, as required for cutting material. A mechanism similar to the one described is used on electric saws manufactured by Böttcher & Gebner, Hamburg, Germany.

Mechanism for Use in Planing Convex Surfaces

By M. JACKER

The mechanism shown diagrammatically in the accompanying illustration is designed for use in planing convex surfaces that conform to parts or arcs of true circles having centers that may be located at any distance from the point of the tool. This device is similar to the one described on page 371 of February MACHINERY, although it is much simpler to construct. The diagram shows only one of the two sides of the mechanism, the opposite side being similar to the one shown. The connecting-rod for oscillating the work-table A is attached at B.

As the motion of the work is not concentric with the convex surface being machined, a somewhat greater heel clearance is required for the tool than for ordinary turning, especially when work of the smallest diameter accommodated by the device is being machined. This clearance can be reduced as the work diameter is increased.



Mechanism Designed for Use in Machining Convex Surfaces of Large Radii

Overcoming Static Charges in Belts

The accumulation of static charges on the driving belts of many machines has been a frequent cause of complaint, as such electrical effects are particularly dangerous in moist atmospheres. The elimination of charges on belts recently became a subject of investigation by prominent manufacturers. As a result, it has been found that the charges can be dissipated by treating belts with an aqueous dispersion of colloidal graphite. This electric furnace product is a good conductor of electricity. Thus, graphite films formed on belts carry static charges from the pulleys to the frames. Dry lubrication is also insured by this treatment.

It is present practice to apply a suspension of colloidal graphite in water directly to the pre-cleaned belts by brushing at the time of assembly. In the case of a machine equipped with untreated belts, the same solution may be applied by holding a brush saturated with it against the moving part.

Recent experiments on the elimination of static in washing machines and similar devices indicate that concentrated colloidal graphite in oil diluted properly with carbon tetrachloride will accomplish the same end. Application to the belts may be made by dipping or brushing.

* * *

Because of the emphasis placed upon first-aid treatment of small cuts and scratches in the plant of the Westinghouse Electric & Mfg. Co. at East Pittsburgh, Pa., there were no serious infections resulting from shop work during the year, according to the Medical Department report. However, the number of first-aid treatments increased approximately 10 per cent.

Die Design and Construction

A Treatise on the Principles Embodied in the Design of
Different Types of Sheet-Metal Blanking, Forming, and
Drawing Dies—Sixth of a Series of Articles

By CHARLES R. CORY*

THE previous article in this series, published in June MACHINERY, dealt with the compound type of blanking and piercing die, describing the construction of the lower member, or punch, and the covering, as well as die-button retainers, punch adapters, the shedding of the pierced slugs, and the use of die-button backing plates. The present article will deal with the construction of the upper member or blanking die, the die adapter, standard punch retainers, inside strippers, springs, and spring guards.

Construction of the Upper Member or Blanking Die

The blanking die or die sections in the case of a compound blanking and piercing die are similar to those used in a return blanking die. Usually, however, the die or die sections are mounted on an adapter rather than directly on the upper shoe casting. This is done only to make the die construction easier. The use of an adapter provides more hand room for the diemaker while locating the piercing punches or their retainers on the upper shoe. Since the die adapter is not in position on the upper shoe while the punches are being located,

there is more vertical clearance available. If the die sections are mounted directly on a finished boss on the upper shoe, there would only be as much vertical hand room as the height of the blanking die sections themselves.

Design of Piercing Punches

Commercially obtainable interchangeable piercing punches are usually employed for piercing holes 1 inch or less in diameter. These punches can be removed from the die without taking it apart. As shown in Fig. 8, they are located in a punch retainer that is fastened to the upper shoe with screws and dowels. Standard commercial punches are available for any fractional size of round or square hole, and for some sizes of oblong holes.

If the shape of the punch point, which will be the shape of the hole when pierced, cannot be determined theoretically, it must be determined by a try-out method. Such a case would be met with if a flat blank is later to be formed to some shape that would stretch or compress the metal around the pierced hole. The hole would then become distorted and would not be like the point of the piercing punch. To obtain the correct shaped hole in the finished part, allowance must be made for this distortion. To determine the correct punch point

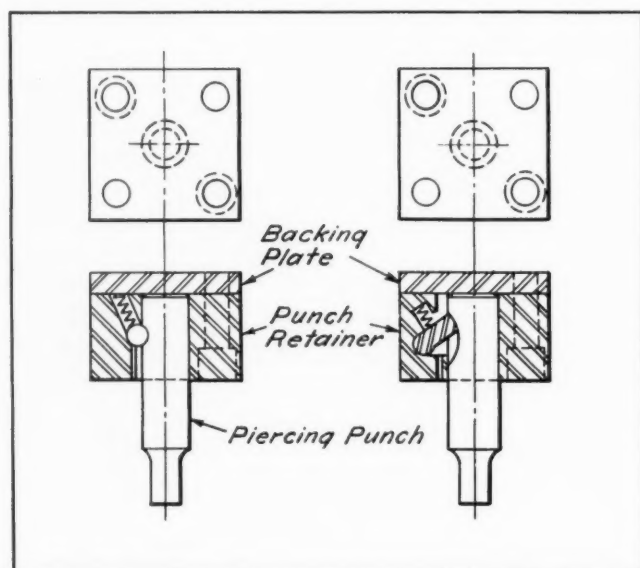


Fig. 8. Commercial Interchangeable Piercing
Punches with Punch Retainers

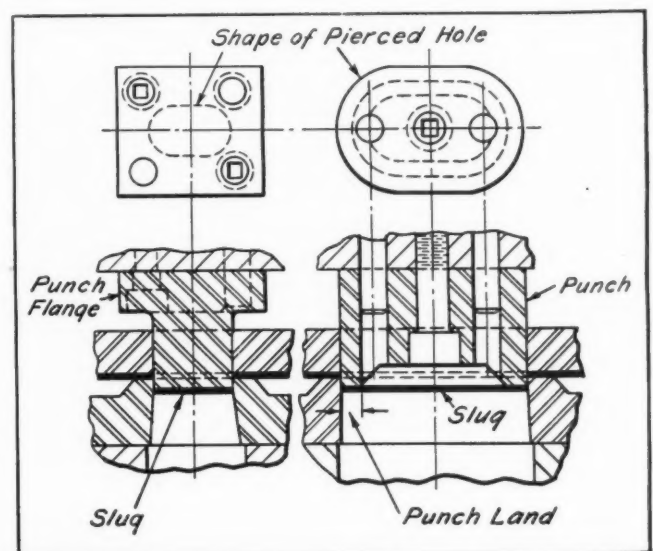


Fig. 9. Solid Type Punches Designed with
and without Flanges

size by a try-out method, holes are drilled or filed in trial blanks which are then run through the various forming dies required. Hand-forming processes may be used to duplicate the work of the dies in order to save the delay of waiting until the forming dies are made.

When a correct finished part is produced, the size and shape of hole filed in the trial blank is the size of the punch required. A templet is sometimes made of the shape of this hole so that the punch can be made to it.

Commercial punches can be obtained for irregular shaped pierced holes. Either the templet or the necessary dimensions should be furnished to the punch manufacturer. If the production of the die cannot be interrupted for sufficient time to wait for a replacement punch, extra punches for irregular shaped holes should be kept in stock.

If standard punches are not to be used, there are three types of specially made punches:

1. A solid type punch can be machined from steel. The screws for holding the piercing punch to the upper shoe should be arranged so that the screw-heads are in the punch. The punch can then be removed from the completed die by first removing the inside stripper plate, without taking the die out of the press. Large punches do not require flanges if the punch area is great enough for screws and dowels. (See Fig. 9 for examples of punches with and without flanges.)

The solid type of punch is cheaper than the retainer type, but replacements are more difficult, since the dowel hole locations in the new punch must be transferred from the old dowel holes in the upper shoe. For large holes the solid type is used, however, because punch replacements are rare, and hence need not be considered.

2. A retainer type punch (Fig. 10) may be inserted in a soft steel punch retainer plate. The punch usually has a round body which is a press fit in a hole in the retainer. The bottom end of the punch, or the piercing point, is made to the shape

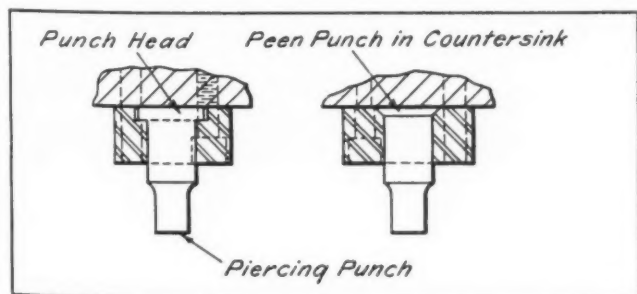


Fig. 10. Retainer Type Punch Inserted in a Soft Steel Punch Retainer Plate

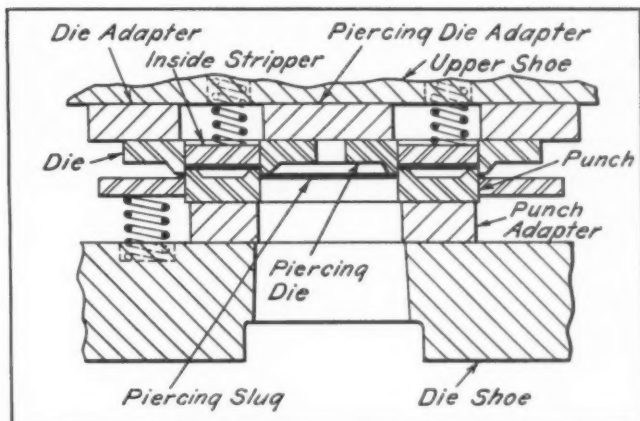


Fig. 11. Sections of Die Mounted on an Adapter

required. This type of punch usually has a head to prevent it from stripping out of the retainer.

If the point of the punch is not circular, it is necessary to prevent the punch from turning. This is done by machining a flat on one side of the punch head, as previously explained in connection with die buttons. (See Fig. 3, page 699, June MACHINERY.)

If the point of the punch is round or square, or of some easily measured and duplicated shape, replacement punches can be made easily and accurately. In that case, the retainer type of punch has an advantage over the solid type because it is easier to replace. The punch location is determined by the retainer, which is not changed when a punch breaks.

3. If the hole to be pierced is too large for the use of a punch made of one piece of steel, the required number of sections is usually mounted on an adapter, as indicated in Fig. 11.

The piercing punches should be shown on a drawing as entering or passing the top surface of the blanking punch $1/16$ inch, when the die is in a closed position. The blanking punch is shown advanced in the die an amount of $1/16$ inch plus the amount of shear required for the thickness of stock being cut. Due to the shear on the blanking die sections, therefore, the piercing will not occur until most of the blanking has been finished. This eliminates the danger of the blanking operation causing a shift of the blank and breaking the piercing punches. This "timing" of blanking and piercing dies is indicated in Fig. 12.

Standard Punch Retainers—Die Adapters

A standard punch retainer set consists of a punch retainer and backing plate. The punch retainer may have to extend beyond the die proper (see Fig. 14, to the left). It may then be ground flush

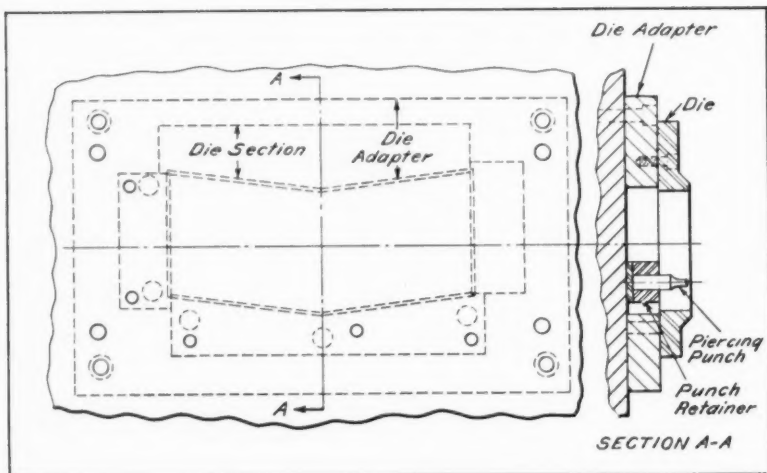


Fig. 13. A Cast-iron Frame Die Adapter

with the die adapter, so as to support the die sections. If this support is not needed, the die sections may bridge over the retainer with a space between the retainer and the die sections, as indicated to the right in Fig. 14.

Standard punch retainers may be ground to clear each other if they are too close to one another. If the interference is too great, a special retainer may be designed of a size and shape to suit the die. Such special retainers are usually detailed separately on the die drawing. If a special punch retainer plate is used, the punch body holes can be located very close together.

The purpose of the die adapter is to provide more hand clearance for locating the piercing punches on the upper shoe, as already mentioned. The use of an adapter is not essential, but is a convenience to the diemaker. In the case of small or medium-sized dies, the adapter is a cast-iron frame, as indicated in Fig. 13. The hole in this frame is large enough to allow the cutting edges of the die sections to overhang about 1/8 inch. The adapter of a large die is usually a series of loose bars or "rails." This construction permits easier fitting of the blanking die sections to the blanking punch sections, and results in lighter units. It is a matter of die construction cost only. If the saving in the time of assembling the die does not more than equal the extra time of machining and fastening the adapter to the upper shoe, an adapter should not be used.

Since the only purpose of the adapter is to make the locating of the punches easier, an adapter need be used only on those sides which are close to the location of the piercing punches. If all the piercing punches are along one side of the part, an adapter rail is only required along that side. The diemaker then can remove that rail and work from that side of the die when setting the piercing punches.

The Inside Stripper or Knock-Out Plate

The inside stripper, or knock-out plate, may be of any one of the six different types described completely under the heading "The Knock-Out Plate" in the article in the April number of MACHINERY re-

lating to return blanking dies; but the addition of the operation of piercing changes the construction of some of these types.

It will be recalled that these types are the direct spring knock-out, the single-pin knock-out, the four-pin knock-out, the press bar knock-out, the pull-down bar knock-out, and the indirect spring knock-out.

The use of the direct spring type is somewhat limited, since the piercing punch retainers decrease the area above the knock-out plate available for springs. The addition of the piercing operation also increases the stripping pressure required.

The single-pin knock-out type must be changed in construction whenever the location of the knock-out pin would interfere with the punch retainers, unless a special punch retainer is used in which a clearance hole for the positive knock-out pin can be provided. In the case of a blanking die, the approximately correct center of stripping pressure can be estimated and the knock-out pin located at that point; but in a blanking and piercing die, a punch retainer may interfere with this location of the knock-out pin. Hence it may be necessary to transmit the pressure of the knock-out pin to the knock-out plate through three or more spacer pins.

Two types of construction may be noted: In the external type, the knock-out pin has a flange at its bottom end, located above the upper shoe shank, as indicated to the left in Fig. 15. To this are attached three or more spacer pins extending down through holes in the shank and upper shoe. The spacer pins push against the inside stripper plate, causing it to strip the blank.

If a shank is not used on the upper shoe, the flange of the knock-out pin could be somewhat below the top surface of the upper shoe. (See Fig. 15, to the right.) It will operate in a cored hole in the top of the upper shoe casting. There may or may not be a cover plate above the knock-out pin flange at the top surface of the shoe, but this does not affect the action.

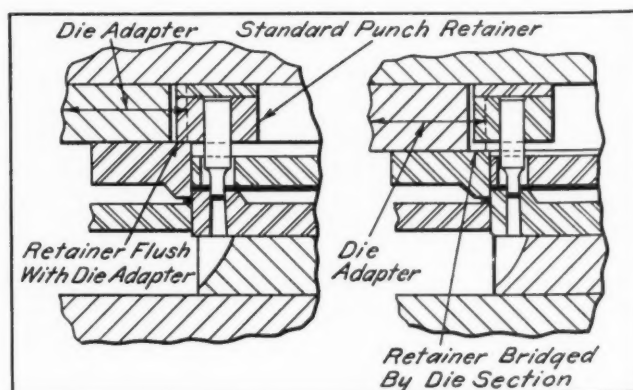


Fig. 14. Diagrams Showing Arrangement when Using Standard Punch Retainers

In the internal type of knock-out pin, the pin extends through the shank and upper shoe and is attached to the knock-out plate above the bottom surface of the upper shoe, as indicated in Fig. 16. Three or more spacer pins attached to the knock-out plate transmit the knock-out pressure. The punch retainers are mounted on a punch retainer adapter which bridges over the cored hole of the upper shoe in which the knock-out plate operates.

The clearance holes in the inside stripper plate for the standard piercing punches should be large enough for the punches to be removed without first removing the stripper plate. In exceptional cases, such as when piercing very thin stock for parts which must not show any distortion, the clearance holes in the stripper may be made large enough for the point of the punch only. In such cases, the stripper plate must be removed before the piercing punches can be removed.

There should be at least 1/4 inch vertical clearance between the stripper plate and any part of the upper shoe or piercing punch retainers when the die is in its closed position. This clearance will permit grinding off the blanking die and bottom surfaces of the piercing punch a total of 1/4 inch for sharpening.

Springs and Spring Guards

Guards made of sheet metal are used to enclose springs and are fastened to the die-shoe. If slugs are shed sidewise through slug chutes in the adapter, they pile up on top of the lower shoe unless the slug chutes continue through the shoe also. In piling up or in being swept off by the operator, the slugs could pass in between the spring coils if there were no guards to prevent this. Spring guards are used only on springs close to the slug chutes.

The free length of the springs used in dies should be so selected that the compression required does not approach too closely the possible compression

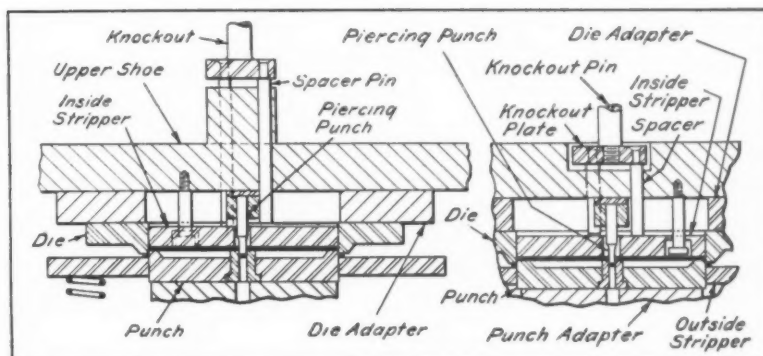


Fig. 15. Designs Using Single-pin Knock-out Plates

of the spring to solid height. For a high-production die, there is an advantage in not compressing it as far as for a low-production die, since the life of the spring depends to a great extent on the degree of compression. The length of the spring should also be sufficient so that the initial compression is great enough to exert the required pressure for the work to be done at the beginning of the working stroke. There is an advantage in using fewer longer springs, rather than a greater number of shorter springs, since the cost is less. The initial compression of the spring should be about 1/2 inch in the case of a blanking die, which makes the final compression about 13/16 inch for most dies of ordinary construction.

* * *

The Tax Burden on Industry

The Koppers Co., Pittsburgh, Pa., has published a booklet entitled "Koppers Yearbook—1938," which gives some interesting facts relating to the company's investment, taxes, and payrolls. The Koppers Co. employs over 10,000 people. In 1937 the company's taxes were 75 per cent greater than the total amount paid out to stockholders. This tax bill was also equal to six weeks' wages for each one of the company's employees. The major share of these taxes was not based upon the company's earnings, and there were no excess or undistributed profits taxes to be paid. Most of the taxes would have been payable whether the company had earned anything during the year or not. In exact figures, the taxes amounted to \$181 for each employee.

The *Koppers Yearbook* also mentions that for every man or woman employed, it had invested \$11,493. The products sold per worker totaled \$6685. Of this, an average of \$1561 was paid to each employee in wages; \$4181 per employee was paid for raw materials, power and supplies, freight and operating expenses; taxes, as mentioned, were \$181 per employee; and \$178 was spent for machinery replacements. There remained \$584 to pay interest on the invested capital and to provide for expansion of the business.

The company increased employment by 11 per cent, but increased its payrolls by 20 per cent, which meant a substantial increase in wages.

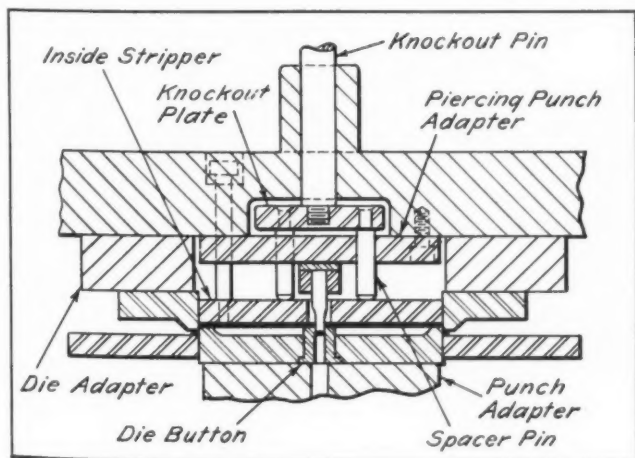


Fig. 16. Illustration Showing Design of an Internal Type Knock-out Plate

Developing Responsibility and Self-Reliance

ON a recent visit to the plant of the Humboldt-Deutzmotoren in Cologne, Germany, the attention of the editor of MACHINERY was called to a most unusual development in personnel methods that has been inaugurated by this manufacturing company.

The plant in question employs 6000 people. In this plant there is a group of workers who, because of their reliability and skill, are designated as "I-inspect-my-own-work" men. This group at present includes some 500 workers.

When a man has proved to the company's satisfaction that he possesses the qualities of ability and responsibility to make it advisable to permit him to be the sole inspector of his own work, the man receives a letter from the company telling him that his qualities as a mechanic have singled him out for this mark of distinction. He also receives an attractive brass sign on which is inscribed "I inspect my own work." This sign is placed on his machine or work-bench and remains there as long as he lives up to the confidence placed in him.

The responsibility placed upon the man is not limited to simply inspecting his own work in such a manner that any other inspection of it is unnecessary; in addition, he is expected (1) to call the attention of his foreman to any errors in drawings or any defects in the work that he may discover; (2) to freely tell the foreman about any errors that he has made himself and to ask for advice in cases of doubt; and (3) to keep his machine, tools, and accessories in such a condition as to set a standard for other workers.

Obviously, the little brass sign, "I inspect my own work," is a mark of honor that is highly prized by the workers. It is conferred only upon workers who have given evidence of their reliability and of their willingness to work not only for, but with the firm in a truly cooperative spirit. It is evident that if the worker should prove disappointing in meeting the expectations of the management, or abuse the privilege accorded him, the mark of honor of being his own inspector would be withdrawn.

A still greater distinction is conferred upon a small group of workers now numbering about fifty in the plant; this honor group is also given a brass sign to place on their machine or work-bench reading "I set my own piece-work rates." Each man in this group is permitted not only to set his own piece-work rates, but to devise his own methods for performing the work, if, in his opinion, it can be done in a better way than that formerly employed. In placing this responsibility upon the worker, he is expected to use his own initiative and to figure his rates in a manner that will prove most advantageous both to the firm and to himself. If he finds that he has made an error in his rate setting, he is expected to freely notify his foreman, so that a correction may be made. He is also expected to

act in an advisory capacity in cases where there are differences of opinion in regard to piece rates among his fellow workers.

In a sense, this group of "rate setters" become their own foremen, since they work practically independently, and are permitted to plan the work they are doing in the manner that, in their opinion, will permit of the greatest production commensurate with the required accuracy, and at a piece-work rate that they themselves determine. Obviously, this method gives an opportunity to men to show their initiative and dependability, and places them in line for further promotion. On the other hand, it is evident that if any man should take undue advantage of the freedom of action given to him, the mark of honor permitting him to be his own planner and rate-setter may be withdrawn.

It was stated by the general manager of the Humboldt-Deutz plant, Dipl.-Ing. H. Stein, that the method has worked entirely satisfactorily and that the men selected to act as their own inspectors and rate-setters have proved that they possess both the ability and integrity required for the success of the system. The plan has also greatly aided in developing the capacity of individual workers and in improving the relationship between management and men throughout the entire plant.

* * *

Industry's Investment in Development Work is Often Overlooked

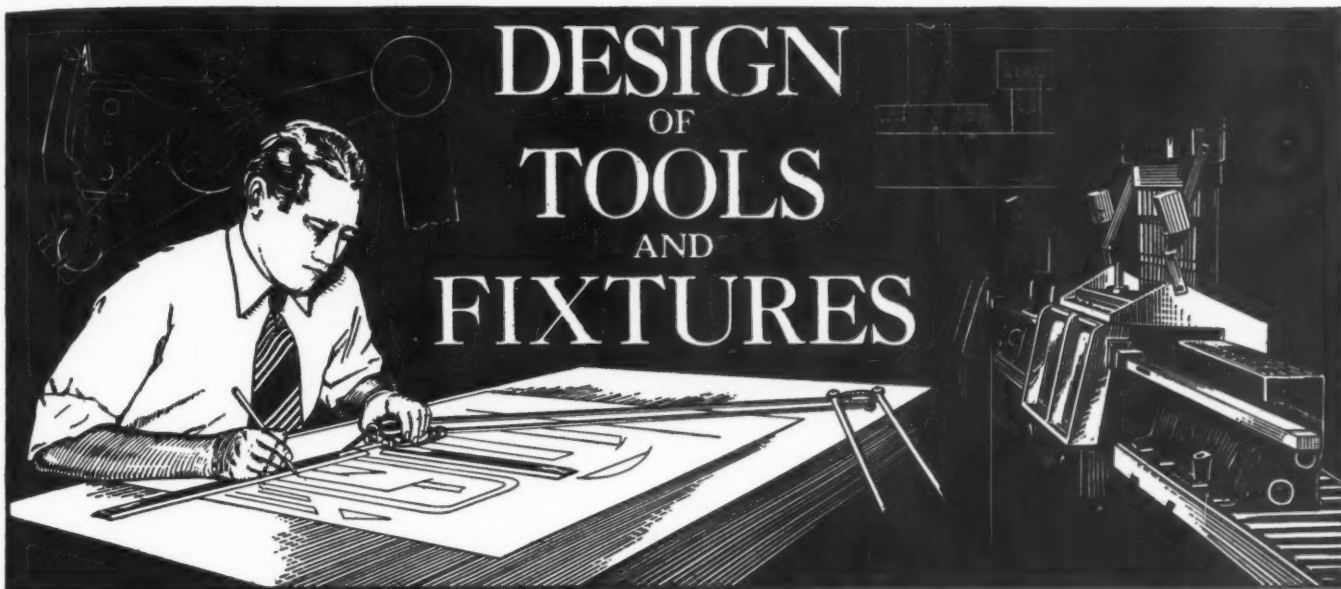
People unfamiliar with industrial work frequently overlook the enormous expenditures of, and risks taken by, industrial companies in carrying on their research work. As one example of the high cost of experimental and research work may be mentioned the fact that an English firm has developed a process to make textiles wrinkleproof, this applying equally to cottons, linens, and rayons. The research work has required fourteen years and an expenditure of \$500,000.

* * *

Handbook of Safety Standards

The National Conservation Bureau of the Association of Casualty and Surety Executives, 60 John St., New York City, has published a revised and enlarged edition of the "Handbook of Industrial Safety Standards," which has in the past been found very useful as a guide for safeguarding working conditions in industrial plants. The new edition contains 192 pages divided into thirty-two chapters with seventy illustrations. The Handbook may be obtained at 39 cents a copy from the National Conservation Bureau at the above address.

DESIGN OF TOOLS AND FIXTURES



Die for Making Cylindrical Collars from Ribbon Stock

By E. W. BEAN, Swampscott, Mass.

The dies for making collars from flat stock in two operations, which were described on page 378 of February, 1938, *MACHINERY*, brought to mind the die shown in Fig. 1, which was designed by the writer several years ago for performing similar work in one operation. The collars produced by

this die were made from soft steel ribbon stock, $\frac{3}{4}$ inch wide by 0.040 inch thick, by forming the material over an arbor $\frac{5}{8}$ inch in diameter. The die was used on a press having a stroke of $2\frac{1}{2}$ inches, which was equipped with an automatic feed.

Section X-X, Fig. 2, shows the die in the closed position, with the ribbon stock indicated by dot-and-dash lines at R. Block B serves as a stop for the ribbon stock, and is provided with a hardened insert C, over which punch D shears the stock to the proper length and then forces it down over ar-

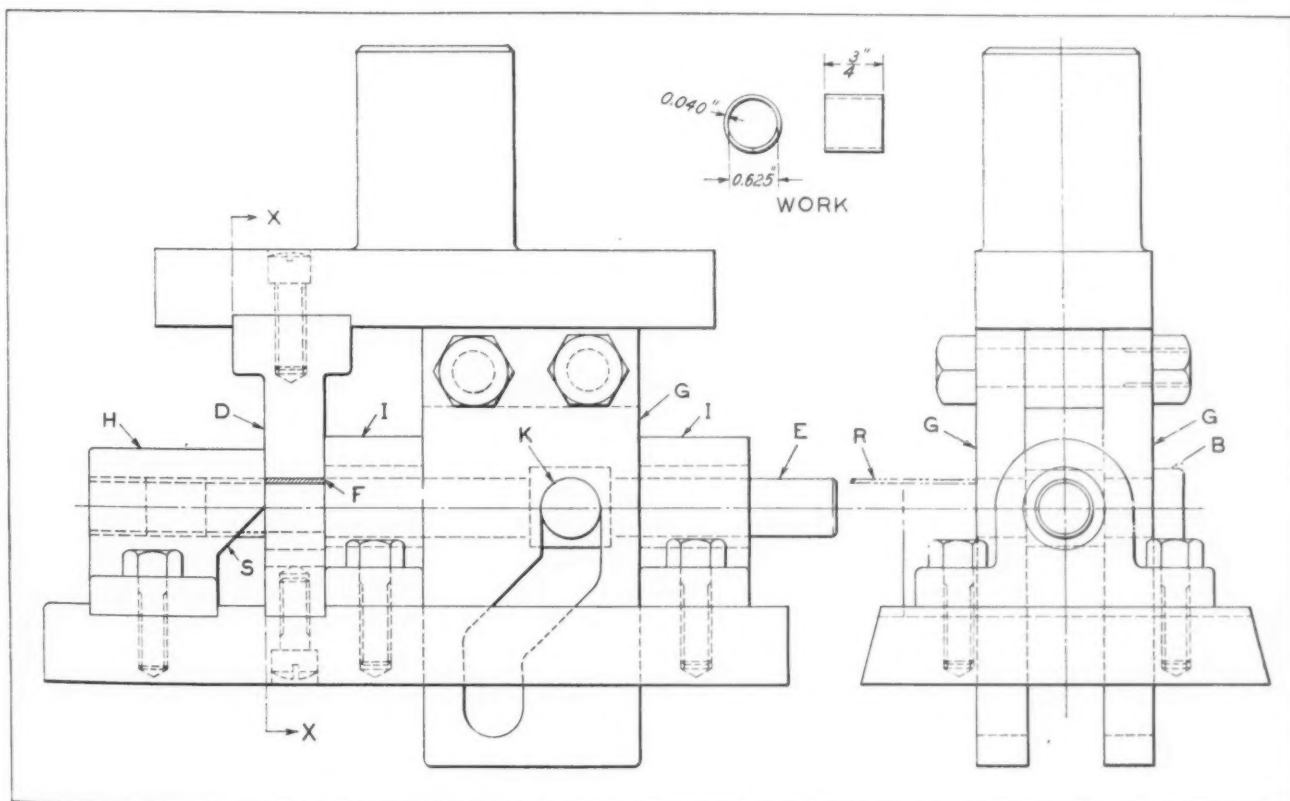


Fig. 1. Die that Cuts off and Forms Ribbon Stock to U-shape on Down Stroke of Press, and Curls the Piece into the Form of a Cylinder on the Up Stroke

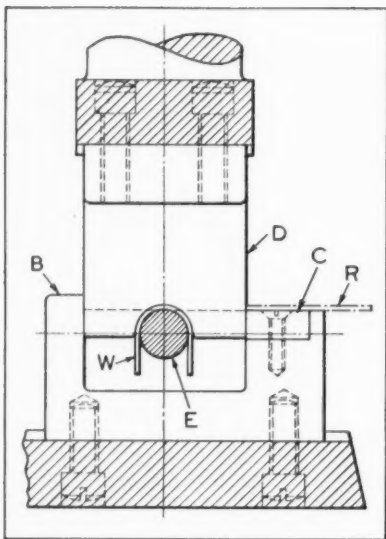


Fig. 2. Section X-X, Fig. 1, Showing Cut-off Piece W Formed to a U-shape

the trunnions *K*, the U-shaped piece is forced into the hardened steel block *H*, which is cut away at an angle, as shown at *S*. Arbor *E* extends through the block *H*, and as it advances or forces the work into the block, angular surface *S* causes the work to be wrapped around arbor *E*. The hole in this block is 0.0005 inch smaller than the formed work, so that the work is ironed out as it is forced through. Spring-back is eliminated by this ironing-out action. When the die is in operation, there are always three collars in block *H* which support arbor *E*, one collar being ejected from block *H* at each stroke of the press.

Fixture for Gang-Milling Square Ends on Four Studs in One Set-Up

By J. KARASH, Tool Design Department
Reliance Electric & Engineering Co.
Cleveland, Ohio

The stud shown at *W* in the accompanying illustration was formerly made by turning blank studs from bar stock to the shape shown at *T*, chucking the piece in a dividing head in an upright position and straddle-milling flats on two sides of the large portion. The dividing head was then indexed 90 degrees and the stud again straddle-milled to complete the piece as shown at *W*.

These studs were normally made up in small quantities. An order for an unusually large run, however, made it desirable to mill several of these studs simultaneously. The fixture shown in the illustration, which was designed for this purpose, is held in a dividing head.

bor *E* into the U-shaped form shown at *W*. On the up stroke of the press, the hardened and ground arbor *E*, Fig. 1, which slides in the bearings *I* and has a shoulder at point *F*, is forced forward by the two cam slots in plates *G* which act on the two trunnions *K* machined on arbor *E*.

As arbor *E* is forced forward by the action of the cam slots on

Four studs *E* are slipped into the bored holes in the body of the fixture and secured by tightening the knurled-head screws *C*.

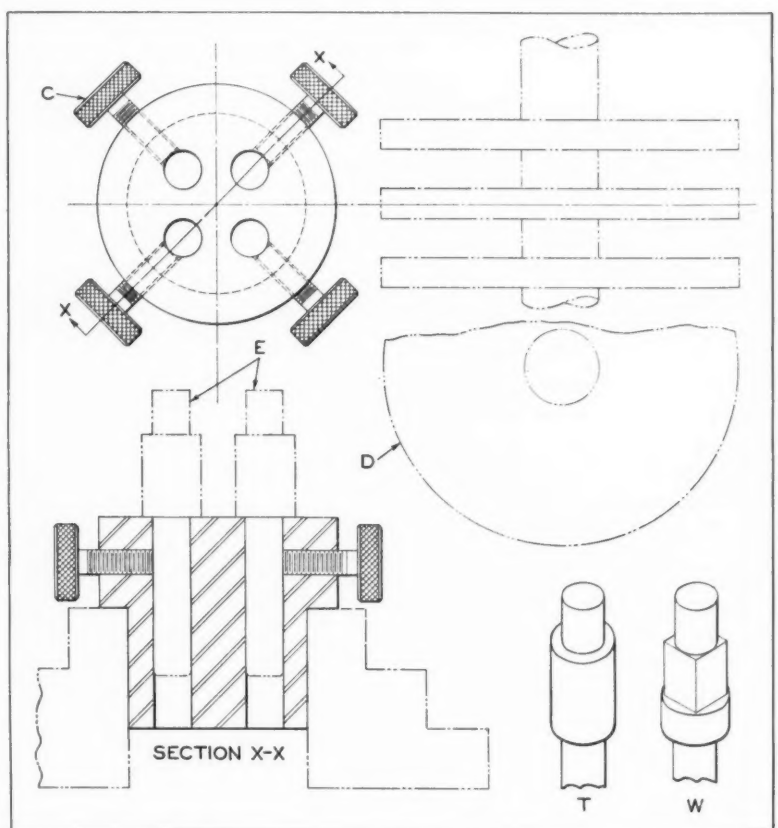
The four pieces are next straddle-milled by the gang cutters *D*. The dividing head is then indexed 90 degrees and the studs again straddle-milled, thus completing a square section on each of four studs. When indexed for the second gang-milling operation, all of the parts rotate about a common center instead of about their own individual centers. This principle can be employed when designing fixtures for milling a larger number of pieces in one set-up.

Fixture for Drilling Collars, Sprockets, and Similar Parts of Various Sizes

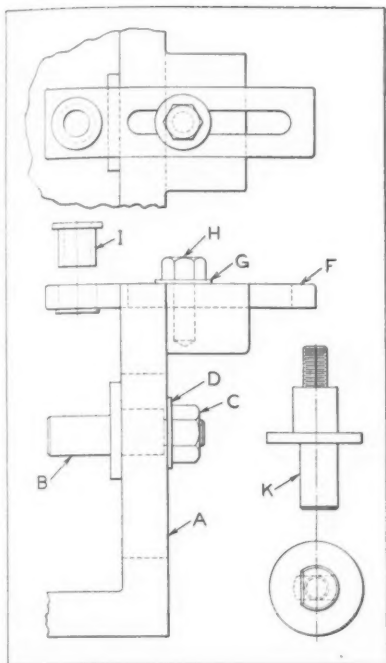
By JOSEPH SCHLINGER, Middleport, N. Y.

The fixture here illustrated has been found very convenient for drilling such parts as sprockets, collars, bushings, bearings, and pillow blocks. It consists essentially of the cast-iron angle-plate *A*, the steel arbor *B* on which the work is mounted, and an adjustable plate *F* in which interchangeable bushings *I* can be inserted.

The work-arbor *B* is held in position in a vertical slot in the plate by a washer *D* and nut *C*. This arbor can be adjusted toward or away from the drill bushing to suit the diameter of the work to be drilled. Interchangeable arbors *B* can be made up to suit different jobs. The arbor can be flatted,



Fixture for Milling Square Ends on Four Studs in One Set-up



Drilling Fixture with Adjustable Bushing Plate and Arbor

each job. Interchangeable bushings *I* for drills of various sizes can be kept on hand to accommodate different jobs. Interchangeable plates *F* can also be made with two or more bushing holes to suit special requirements.

Adjustable Truing Device for Surface Grinding Machines

By J. R. WHITTLES, Holden, Mass.

The accompanying illustration shows a simple device that can be bolted to the table *L* of a surface grinder, as shown, or placed on the magnetic chuck *K*, for truing the grinding wheel face. It is readily adjusted to suit any position to which the wheel may be set for grinding work of different sizes. It has a deflector *B* for carrying the grinding lubricant to the diamond from the discharge spout *E* of the circulating system. The deflector is tapered to guide the grinding lubricant toward the diamond point, thereby keeping the point of the diamond entirely flooded, cool, and at a uniform temperature. This prolongs the life of the diamond, prevents it from checking due to excessive heat, and results in more accurate work.

The body *A* is made of cast iron, with projections at the base for the two T-head bolts *H* that hold down the fixture. The body *A* has a reamed hole for the shaft extension of the deflector *B*, which is adjustable for the various positions of the grinding wheel, as indicated by the dotted lines at *J*. The deflector *B* is made of cast iron and has an angular hole drilled in it in which the diamond nib *C* is mounted and held in place by the set-screw *D*. The

as shown at *K*, to permit the drill to break through the work without drilling into the arbor.

The angle-plate has a slot milled in the boss at its upper end which is a sliding fit over the bushing plate *F*. Plate *F* is held in position by the washer *G* and stud *H*. Stud *H* passes through a slot in plate *F* which permits the plate to be adjusted horizontally to suit the drilling requirements of

diamond nib is placed at a slight angle—about 5 degrees—so that a new truing edge on the diamond can be presented to the wheel when the diamond becomes worn, by simply turning the nib *C* in the member *B*. The regular cross-feed mechanism of the grinding machine is used for indexing and traversing the face of the grinding wheel past the diamond.

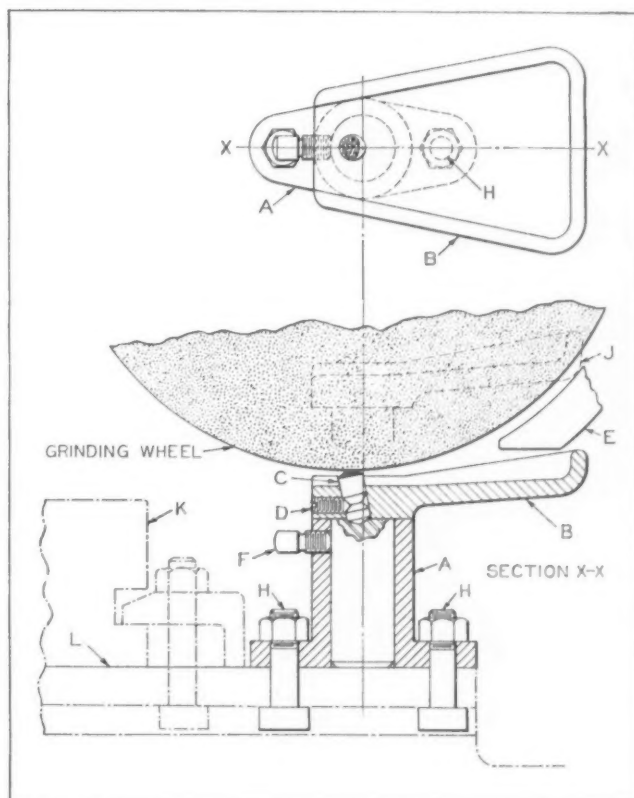
Dies for Drawing Formed Shells of Conical Shape

By M. J. GOLDSTEIN, New York City

Making dies for the production of cone-shaped shells, such as shown at *B*, Fig. 1, (see next page) often presents difficulties. The smaller the radius of the end or nose formed at the apex of the shell, the greater are the difficulties experienced in designing the forming dies. Generally, trouble in drawing shells of this kind can be eliminated by using a properly designed die for the first drawing operation.

The design of the dies used successfully in making the shell *B*, Fig. 1, is shown by the outline views in Fig. 2. The formed shell has a hole at the apex, which is punched in the second-operation die, shown at *E*. Equipping this die for punching the hole eliminates one handling of the work.

The shell is drawn from 24-gage (0.020 inch thick) deep-drawing copper, obtained in coils 6 1/2



Wheel-truing Device for Surface Grinding Machine

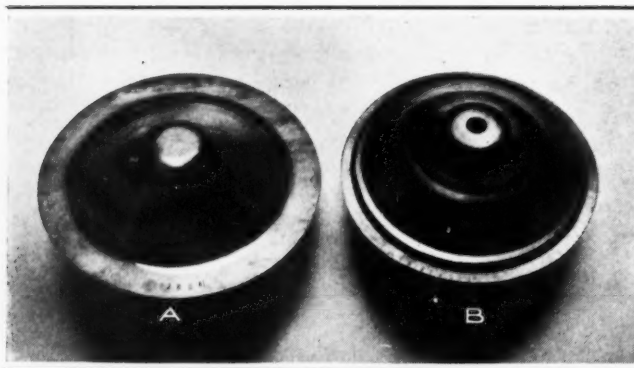


Fig. 1. Copper Shells Formed in First and Second Operations in Producing Lamp Base

inches wide. The die used for the first operation is shown at *D*. This is an ordinary combination die designed to form the blank to the shape shown at *A*, Fig. 1 and at *F*, Fig. 2. The shoe of this die is cast iron, and the plug over which the metal is formed is cold-rolled steel. The pressure-ring and the cutting ring are tool steel, and are hardened and ground. The punch is made of tool steel with a machine-steel back and shank. The punch is also hardened and ground.

The shape of the plug and punch is most important. Reference to view *C* shows clearly the basic principle on which the drawing dies for shells of this type are designed. It will be noted that the shell *F*, formed in the first operation on the die shown at *D*, has the same general angle or shape as the finished shell *G*. In the first operation, the shell is drawn to a depth of $1 \frac{5}{16}$ inches. This depth, of course, in a pointed shell, can only be obtained by having a fairly large radius on the drawing punch. In this case, the radius is $\frac{3}{4}$ inch. The radius on the plug is $\frac{7}{16}$ inch. The large radii used enabled the shell to be drawn without breakage or straining of the metal. A rubber spring barrel type buffer, 6 inches in diameter by 8 inches long, is used on the die for the first operation.

The die for the second operation is shown at *E*. The formed plug is mounted on a cast-iron plate which has a 1-inch thread at the center to accommodate a hollow spring barrel rod 1 inch in diameter. The $\frac{1}{2}$ -inch hole drilled completely through this rod allows the scrap stock from the perforating operation to fall through. The plug is cold-rolled steel and has a perforating die inserted at the upper end, which is a forced fit in the plug. The pressure-ring consists of a machined and ground ring, supported on four pins through which pressure is exerted by a rubber spring barrel, 6 inches in diameter by 8 inches long. The punch is hardened tool steel and is fastened to a machine-steel back. The knock-out is made of cold-rolled steel and acts as a forming punch for shaping the shell. Two pieces of $\frac{1}{4}$ -

inch drill rod which pass through the shank act as knock-out pins. The punch, $\frac{3}{8}$ inch in diameter at the working end, is also mounted in the shank.

The die *D* produces a clean, smoothly formed shell in the first operation. The punch *H* in die *E* pierces the hole in the shell just before the end of the stroke is reached, and the stretching action on the metal serves to enlarge the hole to a diameter of $\frac{13}{32}$ inch, which is the clearance size for a $\frac{1}{8}$ -inch threaded pipe.

Further operations on the shell, which comprises the base of a lamp, consist of trimming and beading. These two operations are performed at one setting on a trimming and beading lathe.

* * *

Expansion in Germany's Machine Tool Exports

According to an item in *World Machinery News*, published by the Bureau of Foreign and Domestic Commerce, Washington, D. C., in 1936 Germany exported metal-working machinery to a value of approximately \$50,000,000, based on the present exchange of 2.5 marks being about equal to \$1. In 1937, these exports increased to approximately \$72,000,000. In order of importance, Russia, the United Kingdom, Italy, Rumania, and Japan were the leading customers for German machine tools in 1937. Soviet Russia imported German machine tools to a value of approximately \$18,000,000; the United Kingdom, \$8,100,000; and Italy, \$6,500,000.

* * *

The first three stainless-steel table knives ever made and put into use were recently lent to the Stainless Steel Exposition in New York by the manufacturers, a Sheffield, England, cutlery firm. These and all early stainless-steel knives form a striking contrast to the product of today.

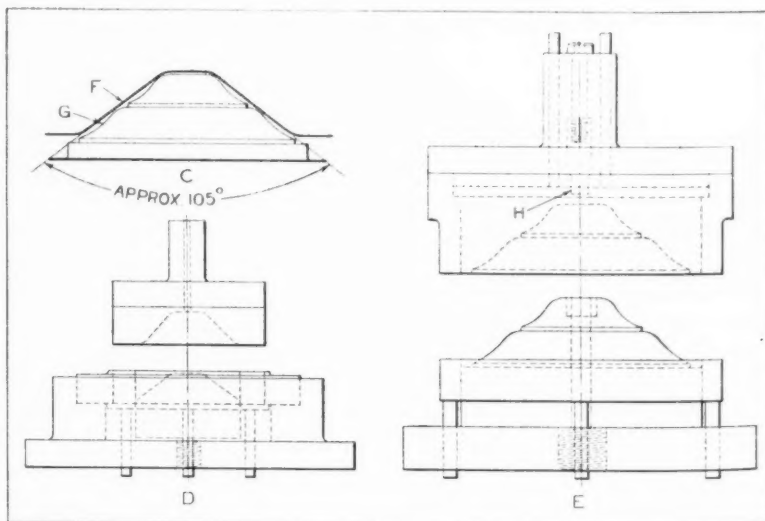


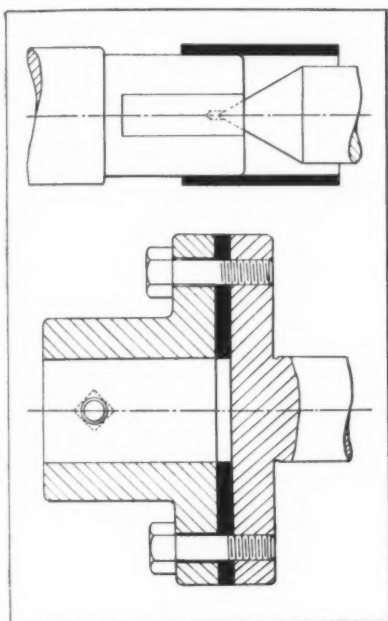
Fig. 2. Dies Used in Blanking, Forming, and Piercing Shells as Shown in Fig. 1

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Using Rubber in Lathe Set-Ups

If the work being done on a lathe produces abrasive dust or chips, the center can be protected and kept clean by slipping a piece of rubber tubing over the end of the arbor, as shown by the black cross-section in the upper view of the accompanying illustration.



Two Uses for Rubber in Lathe Set-ups

The lower view shows how a floating holder for turret lathes is made for holding drills, reamers, counterbores, etc., by the insertion of a piece of rubber between the flanges of the tool and the turret. With this arrangement, the tool will have a floating action similar to that obtained with the usual shank and cross-pin type of holder.

F. H.

Beading Tool for Use in Drill Press

A tool designed for beading or crimping the ends of cylindrical-shaped cans that comprise the bodies of flour sifters is shown in the accompanying illustration. The tool is used in a drill press having a stroke of 1 inch. The hand feed-lever of the drill press is counterbalanced and fitted with a foot-treadle, so that the operator can remain seated and his hands will be free to hold the cans down on the table of the machine.

A piece of wood, bored to provide a loose fit on the can for a depth of about 1/4 inch, is attached to the press table for locating the work in line with the beading tool. The operator grips the can with his hands while bringing the beading tool down by depressing the foot-treadle. The tool produces a small circular bead-like rim or wiring. The crimping can be done rapidly, with a spindle speed of

about 200 revolutions per minute. A small vee is cut from the metal container at the lock seam, so that only one thickness of the metal is crimped at this point.

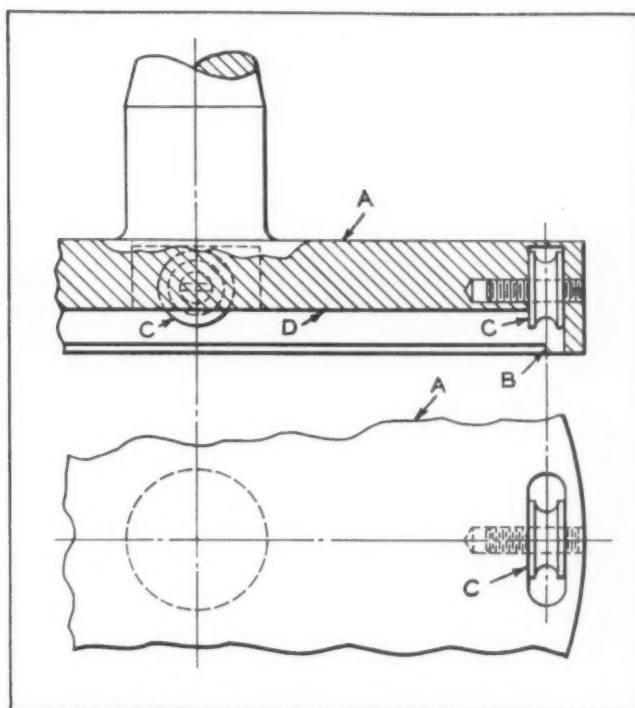
The disk-shaped machine-steel body A of the tool, only a section of which is shown in the illustration, is bored to a loose fit on the can. The edge at B is slightly beveled to facilitate entering the work. Three or four small hardened beading rollers C are spaced around the edge of the bore in body A. These rollers have grooves formed to the radius required to give the edge of the work the desired crimp or bead. The rollers project slightly below surface D, so that the work will clear this surface.

Marshalltown, Iowa

GEORGE WILSON

* * *

In 1903, the largest turbine generator in service was a 5000-kilowatt machine installed in Chicago. It was ten times larger than any previous unit. Today, the largest machine in service, also in Chicago, is forty-two times the size of the "colossal" machine of 1903.—W. E. Blowney, General Electric Co., in a paper read before the Midwest Power Conference at Chicago.



Section of Beading Tool, Showing Two of the Four Equally Spaced Rollers C

Making Rear-Axle Housings from Steel Strip

By C. C. EDELEN
Surface Combustion Corporation, Toledo, Ohio



Fig. 1. Successive Steps in Forming Automobile Rear-axle Housings from One Piece of Seamless Steel Tubing. This Method has been Further Improved by Forming the Tubing from a Flat Strip, Electrically Welded

REAR-AXLE housings that were formerly made from a single casting or from a cast differential carrier with riveted steel tubes, are today made from seamless tubing or from flat strip by a newly developed process of forging, heat-treating, and welding. This method of making the housings produces a stronger and lighter product at a lower total cost. The process of forming and heat-treating these housings will be briefly reviewed in this article.

The successive steps in forming the housing from a piece of tubing are shown in Fig. 1. As indicated, two slots are first pierced through the center of the tube, then the ends are swaged, and the central part is expanded to form the "banjo." Following this operation, the brake support flanges are welded to the housing.

This process was developed by the Clark Equipment Co., Buchanan, Mich., and a modern plant was built by the company for the making of housings by this method. Until recently the starting point was seamless tubing of the required diameter, length, and wall thickness, as purchased from a steel mill. Equipment has since been developed, however, for forming the tubing from flat strip, electrically welded.

The process, when using flat strip, differs slightly in the first stages from that used when tubing is employed as the starting point. For example, at the beginning of the process, the flat strip, cut to size, has two elongated holes punched in it. Then it is cold-formed by a series of presses and rolls to form a tube. Automatic electric welding machines weld the seam. The tube is cold-rolled to size and delivered into a sloping hearth pusher type heating furnace, where welding and cold-rolling strains are relieved, and from which the tube is delivered hot to a double reversing swaging mill, where the two ends are made smaller in diameter and longer, as indicated in the third step in Fig. 1.

The partially formed tube is then delivered to a double-strand chain conveyor which elevates it and carries it through a double-slot forge furnace, where the center portion only is heated to forging temperature. The heated tube is discharged to a press which expands and spreads the center portion in one operation and then flattens and forms the "banjo" flanges in a second operation.

The housings are then placed on a conveyor which delivers them to one of four large continuous

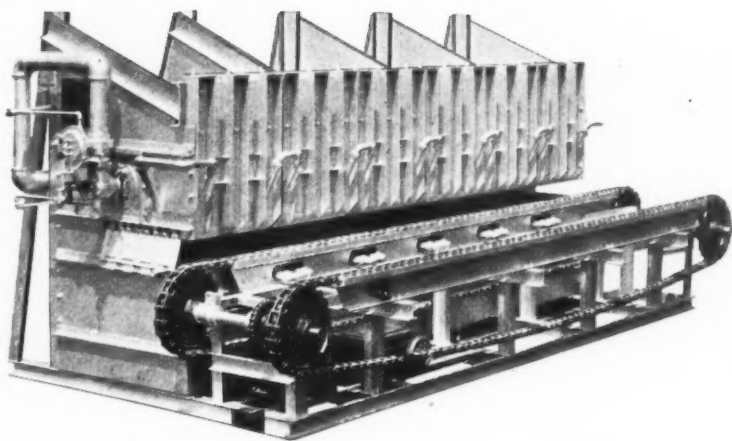


Fig. 2. Slot Forge Furnace for Heating the Ends of the Housings Preparatory to Upsetting

slot forge furnaces, where one end is heated for upsetting. In the upsetting operation, the wall thickness is increased from about 0.325 inch to 9/16 inch, and the diameter is reduced. For this operation, the part which is worked must be heated to a very plastic state—approximately 2400 degrees F.—and yet the adjacent portion of the tube must be cold and rigid so that it will not slip in the gripping dies of the upsetting hammer.

One of the four forge furnaces is shown in Fig. 2. This is an oil-burning furnace, fired above the work from the discharging end and below the work from the charging end. The required sharp heat cut-off is accomplished by means of water-cooled lintels located immediately above and below the slot. The tubes are manually loaded at the charging end, with the "banjo" between the chains and with a measured length of tube extending into the furnace beyond the water-cooled lintels. The housings are delivered to the hammer operator uniformly heated and at a uniform rate. The forge furnace has automatic temperature-control equipment and a variable-speed transmission for the conveyor drive.

After upsetting, the dimensions of the housings are checked. They are then put on a cooling conveyor which returns them to the charging end of the furnace, so that the other end may be heated and upset. The housings are then placed on a conveyor which carries them to the electric welders, where spring pads, brake-drum flanges, and "banjo" flange reinforcements are welded on, using semi-automatic machines.

The fully formed housings are then placed on a storage rack at the charging end of one of two hardening and drawing furnace units. Fig. 3 shows the charging end of the hardening furnace and the discharging end of the drawing furnace in the same production line. A similar set-up is installed in the other production lines. The furnaces shown

are shoe-pusher type gas-fired furnaces. The housings are manually loaded on alloy shoes that rest upon alloy rails extending longitudinally through the furnaces.

The furnace doors and pusher are electrically operated and interlocked; they operate automatically on a set cycle controlled by a time clock. Burners fire both above and below the work and are arranged to cause maximum circulation of furnace gases and uniformity of temperature throughout the furnace. This firing equipment is arranged for automatic control of both temperature and atmosphere. Safety pilots are provided on all burners in the drawing furnace. The furnaces are lined with insulating refractory brick, and the flue gases pass out of the furnace at the

charging end over the cold work—features which insure maximum fuel efficiency.

At the discharging end of the hardening furnace, the housings are manually removed and placed in a quenching machine, which first clamps the housing into alignment, then spray-quenches it uniformly from all sides with water, and finally immerses it in water for a predetermined length of time. The housings emerge still warm, and are placed immediately in the drawing furnace. After the drawing cycle, the housings are sand-blasted and inspected. They are then ready for the machining operations. These operations were described in an article in *MACHINERY*, April, 1937, page 496. The furnaces shown were designed, fabricated, and installed in the Clark Equipment Co.'s plant by the Surface Combustion Corporation, Toledo, Ohio.

* * *

According to *Railroad Data*, the investment in rail roadway averages \$61,000 per mile of line, including sidings and multiple main tracks.

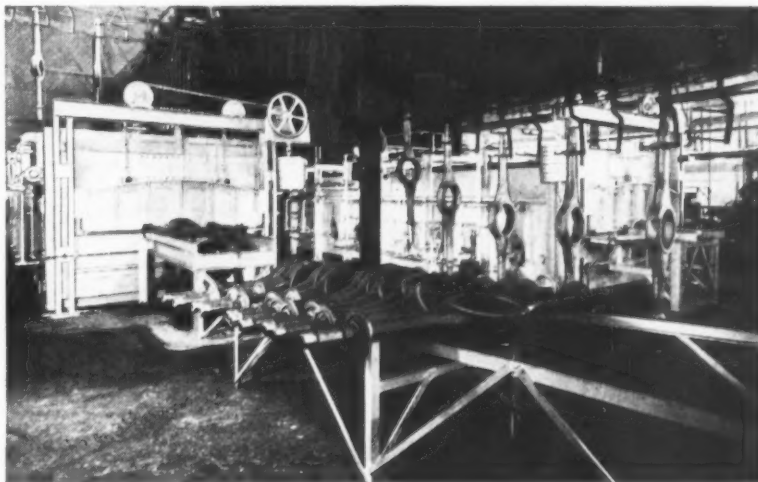
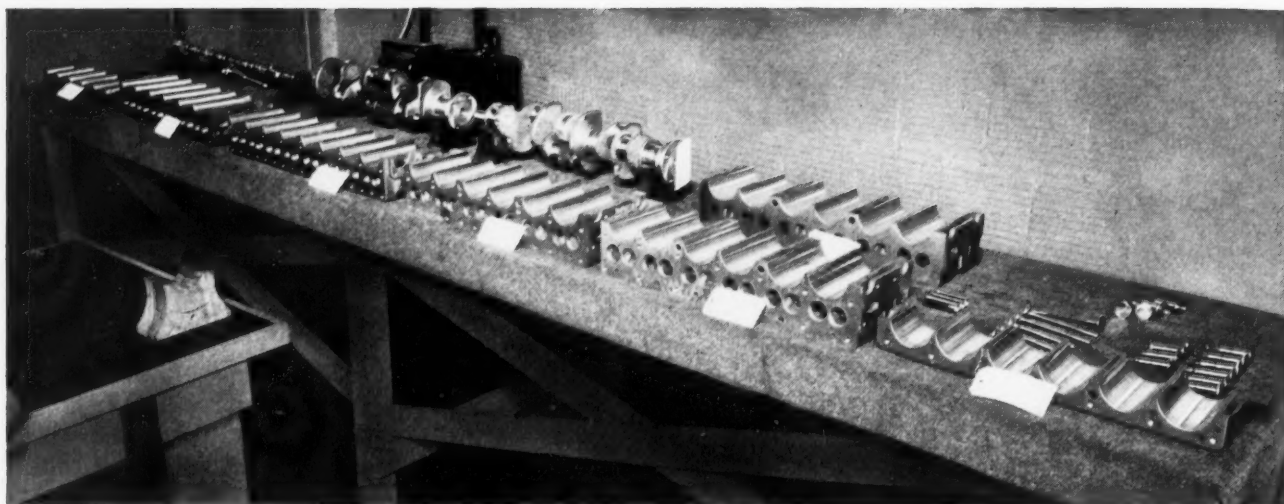


Fig. 3. Charging End of Hardening Furnace and Discharging End of Drawing Furnace



Display of a Variety of Superfinished Automobile Parts

Superfinish—A Basically New

AN entirely new method for finishing the surfaces of machined parts in commercial production, known as "Superfinishing," has been developed by the mechanical laboratories of the Chrysler Corporation in Detroit under the direction of David A. Wallace, formerly vice-president in charge of manufacturing of the Chrysler Sales Corporation, a division of the Chrysler Corporation, and now president of that division. The machines for producing Superfinish are being built by the Foster Machine Co., Elkhart, Ind., under license of the Chrysler Corporation. Since this

A New Method for Finishing Surfaces, Developed by the Chrysler Corporation in Cooperation with the Foster Machine Co., Makes it Possible to Obtain an Unusually High Finish with Almost Unbelievable Rapidity

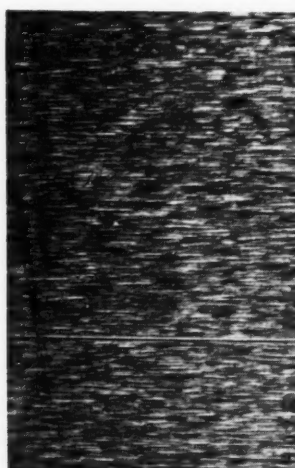
method permits results to be obtained in everyday manufacturing practice that have formerly been considered impracticable, the process marks one of those revolutionary steps in shop methods that are met with only at rare intervals.

Just as grinding, honing, and lapping produce finishes characteristic of the process used, so Superfinishing produces a finish wholly different from that obtained by other methods. These finishes are capable of exact evaluation, since they may be measured by the use of the Profilometer, a newly developed instrument which records the average

(Left) Superfinished Surface with No Defects or Scratches. (Right) Superfinished Surface with Scratches Only One-millionth Inch Deep



(Left) Photograph of Finish on Valve Stem as Purchased. (Right) Same Valve Stem Superfinished to 3.5 Micro-inches, Showing Smoothness





Other Parts Regularly Superfinished in the Chrysler Plant

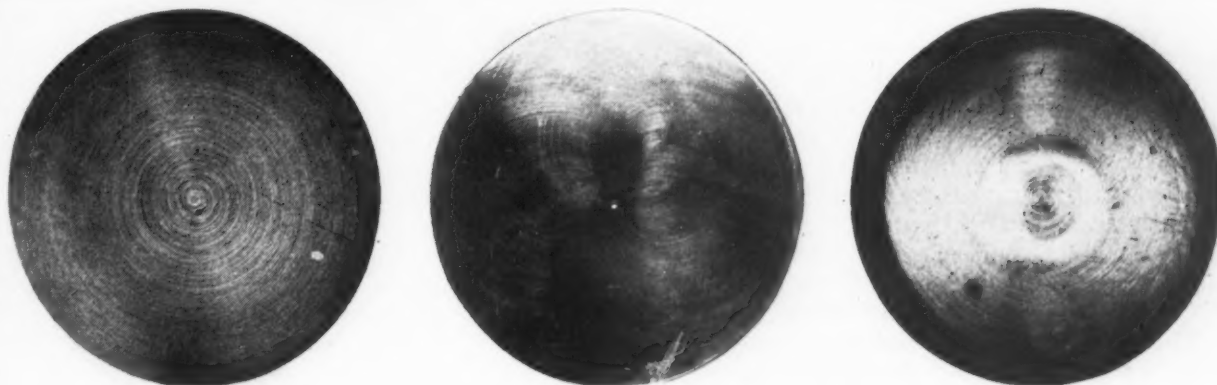
Method for Finishing Surfaces

depth of the grooves or scratches resulting from the tool or abrasive used in finishing a surface. This instrument records the average depth of scratches so minute as to be less than one-millionth of an inch. In connection with the use of this instrument, a millionth of an inch is, for the sake of simplicity, referred to as a "micro-inch."

In order to give, right at the beginning of this article, a conception of the remarkable results obtained by Superfinishing, the actual measurements of the finishes obtained by various processes in the manufacture of automobile parts will be quoted. A brake-drum bored with a 0.022-inch feed has a finish of 110 micro-inches—that is, the average depth of the grooves or scratches left by the tool is 110 millionths inch. After Superfinishing (requiring in this case only 30 seconds), the same surface will show a finish of 11 micro-inches.

A rough-ground crankshaft has a finish of 50 micro-inches; after Superfinishing, 6 micro-inches. A rough-ground piston having a finish of 35 micro-inches is commercially Superfinished to a smoothness of 6 micro-inches. A reamed cylinder with a finish of 26 micro-inches is Superfinished to 4 micro-inches. A finish-ground camshaft showing a finish of 16 micro-inches is Superfinished to 4 micro-inches. A finish-ground tappet head of unusual smoothness shows a finish of 6 micro-inches. Superfinishing this tappet head produces in a few seconds a finish of 2 micro-inches. It might be noted here that if a still higher degree of finish is desirable or required, a slight increase in the time used for the Superfinishing operation will produce these surfaces to a smoothness of 1 micro-inch or even less. The illustrations at the bottom of this and the opposite page indicate results obtained.

(Left) Finish of Valve-tappet Head as Purchased. (Center) Same Valve-tappet Head Superfinished to 2 Micro-inches. (Right) Illustration Showing How the Superfinisher Brings Out Lack of Flatness in Tappet Heads, Due to Previous Operation



Having now indicated in a general way what Superfinish will accomplish, it may be well to briefly review the various processes for machining and finishing metal surfaces before referring to the methods by which Superfinish is obtained and the machines employed in the newly developed operation. While Superfinish is applicable equally to flat or cylindrical work or to irregular surfaces, like those of cams, we will refer in the following specifically to the machining and finishing of cylindrical surfaces. Such surfaces may have a (1) turned finish; (2) ground finish; (3) honed finish; (4) lapped finish; or (5) Superfinish. Only finishes produced in mass production are referred to. The

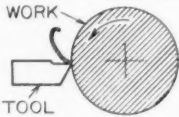

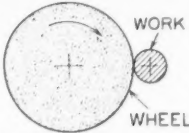
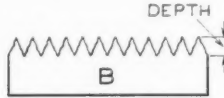
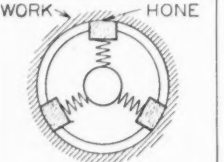
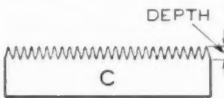
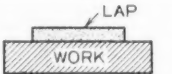
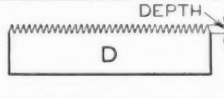

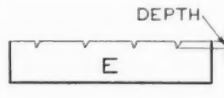
and heat-treatment of the part; the cutting speed and feed; and the temperature to which the surface of the part is being raised by the turning operation.

The last factor mentioned—the temperature of the surface of the part—is of great importance in connection with the finish. The heat produced by the speed and pressure of the tool causes considerable softness or ductility on the surface of the metal being turned. The temperature of the piece on the surface, at the point of the tool, may rise to from 600 to 700 degrees F., which easily causes surface scratches on the work. Past methods to reduce these surface defects by burnishing, rolling, or polishing with a file or abrasive papers and cloths, are not suitable in mass production.

At B is shown diagrammatically and in an exaggerated form the surface resulting from grinding a cylindrical part. Here the ridges and scratches are much less pronounced than in turning, but they are still present. Since for many purposes turned finishes are unsuitable, or too expensive commercially, a rapid development has taken place in the field of grinding machines and abrasive wheels. Great credit is due the manufacturers producing such equipment, for the development of means that are very effective in commercial production. Still, there are instances where a finish finer than that obtained by grinding is required. In producing a ground finish, the part must be reduced an appreciable amount in dimension or size. This requires a high speed and appreciable pressure of the grinding wheel, which induces heat and produces surface ductility. The temperature of the surface, according to laboratory tests at the Chrysler Corporation, rises to from 600 to 800 degrees F., thereby softening the surface and increasing the liability to surface scratches. Even with the best of coolants, this temperature rise has been found to be present.

The honing process, as applied today in commercial production, is a type of grinding, but it is entirely different from grinding with a cylindrical wheel in that the hone, which is the tool used to carry the abrasive blocks that produce the finish, is so designed as to contact with several portions of the surface simultaneously. The hone consists of three or more abrasive stones radially pressed against the work by various means.

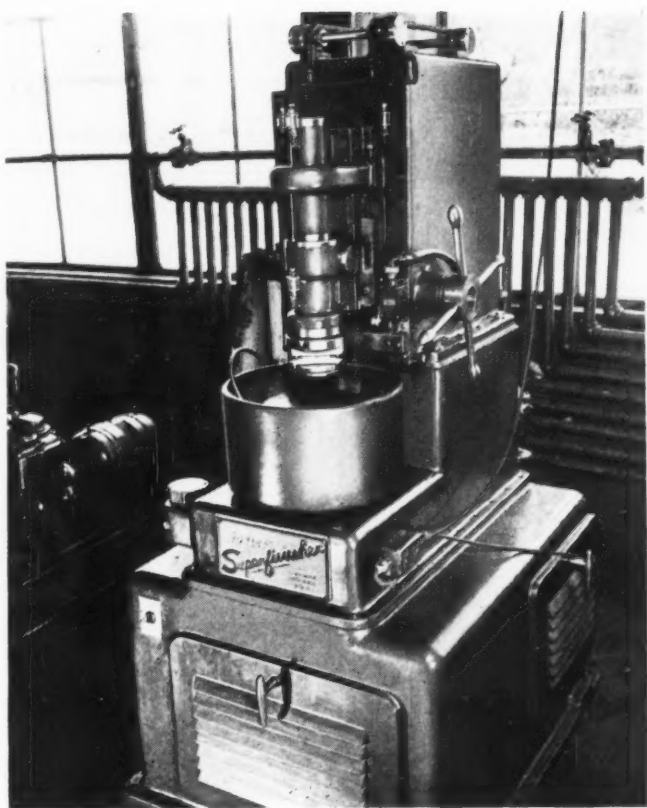
Honing is not limited to line contact with the work, as in the case of a grinding wheel; on the other hand, the hone has a large area in contact with the surface being finished. In most commercial work, it presents several square inches of abrasive surface to the work. This limits the pressure per square inch to only a fraction of that present in cylindrical grinding. This, in turn, re-

TYPE OF FINISH	METHOD OF PRODUCING FINISH	ENLARGED DIAGRAMS OF SCRATCHES PRODUCED	APPROXIMATE RANGE OF DEPTH OF SCRATCHES, MICRO-INCHES
TURNED			50 TO 500
GROUND			35 TO 200
HONED			5 TO 50
LAPPED			3 TO 10
SUPER-FINISH			0.5 TO 10

Diagrammatic Views Indicating in an Exaggerated Manner the Degree of Finish Obtained from Different Methods of Machining and Finishing Surfaces, as Commercially Applied

discussion in this case is limited to surface finish and at the moment has no relation to dimensional accuracy.

At A in the diagram shown above, the surface resulting from turning with a single-point tool is diagrammatically indicated in an exaggerated manner. This method of producing a finish changes the dimensions of the part. The finish produced is influenced by many factors, some of which are: The type, finish, and shape of the tool; the condition of the machine tool; the type of material being finished; the lubricant or coolant used; the hardness



Flat Surface Superfinishing Machine Applicable
to Diameters Up to 12 inches



Valve-stem Superfinishing Machine, with Fixture
Holding Thirty-three Valve Stems

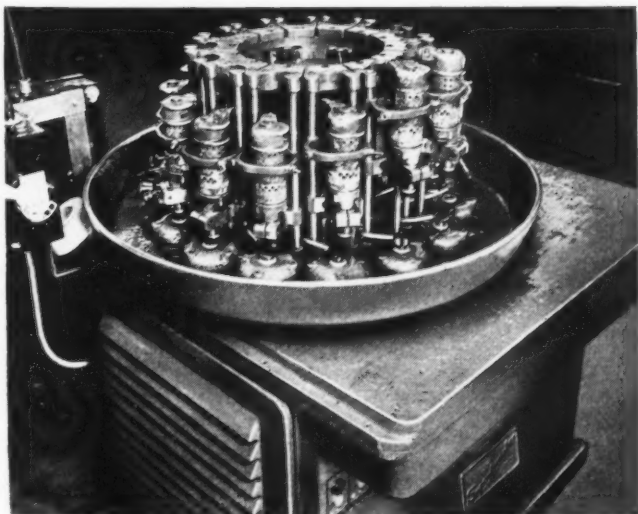
duces the ability to remove stock; but it permits of sizing holes to very close limits with a high degree of finish, which has gained for the process wide commercial application.

To obtain a finish by honing, however, requires some dimensional change in the work, and this, in turn, involves the application of pressure in conjunction with speed. The speed used in honing runs from about 300 to 1000 feet a minute. Pressures from a few pounds up to as high as 50 to 60 pounds are applied. This, again, produces heat. While much of the heat is taken care of by different types

of coolant, the same as in the other finishing processes referred to, there is, because of the large contact surfaces, considerable excess heat that causes a softening of the surface, which is conducive to producing microscopic surface scratches. Since the hone has two motions, one longitudinal and one circular, it produces a cross-hatch finish.

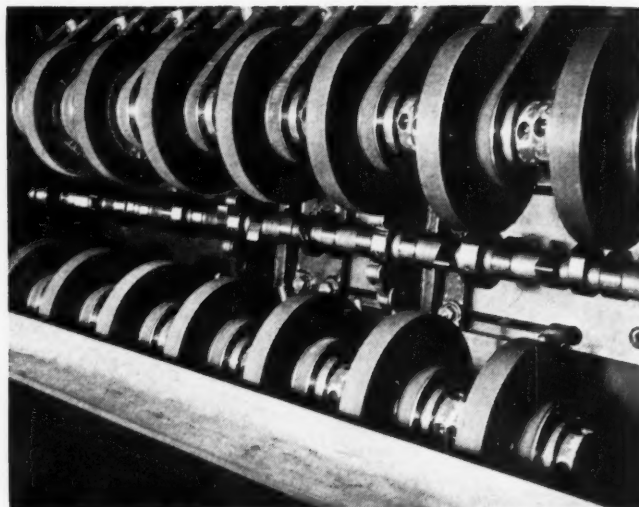
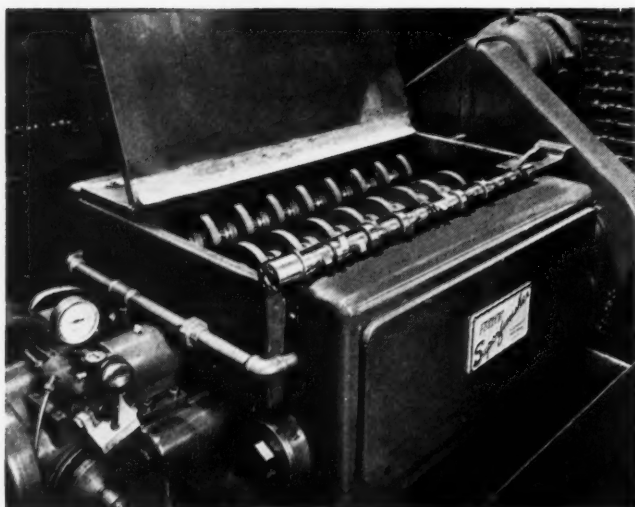
Lapping is an old method for obtaining a high finish. It has been used hundreds of years for producing a finish on optical glass and on jewels. In lapping, the abrasive is a powder, which may be some form of rotten stone, pumice stone, pow-

Continuous Tappet-head Superfinishing Machine
with Fourteen Spindles



Close-up of Continuous Superfinishing Machine
for Valve-tappet Heads





(Left) Machine for Superfinishing the Camshaft Cams. (Right) Looking Down in the Cam Superfinishing Machine. The Camshaft is Shown in Position Before Wheels are Lowered

dered emery, diamond dust, or artificial abrasive. The abrasive is mixed with different types of carriers, such as grease or oil, or charged into the porous surface of wood, cast iron, or brass blocks. Lapping requires a great amount of personal skill. The operation is slow and the resultant finish depends largely on the ability of the workman. The operation is too expensive for commercial mass production.

Lapping usually leaves a finish of minute

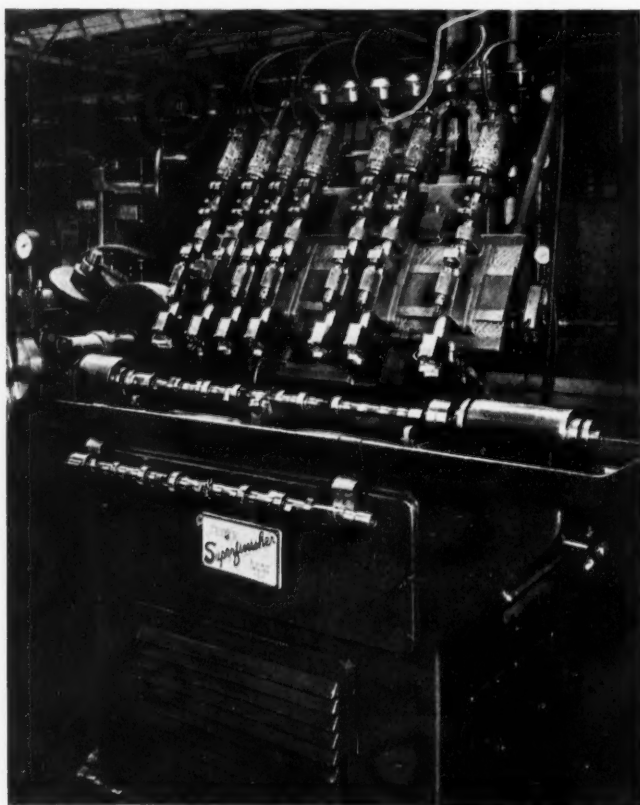
scratches, finer than those left by honing, as indicated at *D* in the diagram. The magnitude of these scratches can, however, easily be determined by the Profilometer, and they are easily seen under the microscope. They are also revealed by microphotography.

Superfinish as a Means for Obtaining High Finish

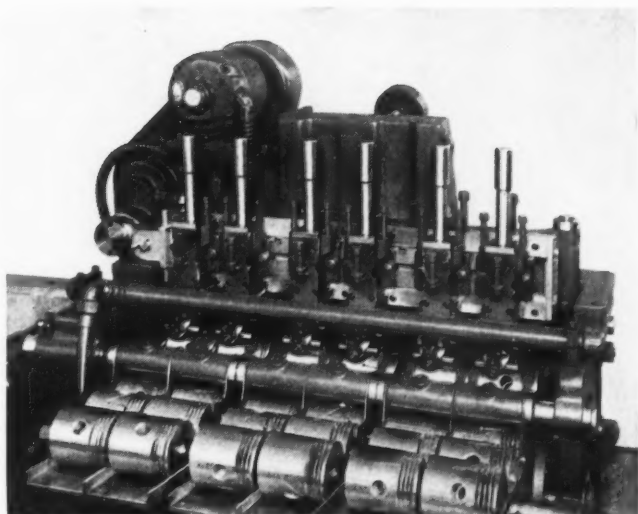
Mr. Wallace, who is responsible for the development of the new process of Superfinishing, describes this type of finish as follows: "Superfinish is an extremely fine surface finish produced upon flat, internal, external, round, concave, convex, and other types of surfaces by a combination of short motions, light abrasive pressures, slow abrasive cutting speeds, hard abrasive stones, and a lubricant of proper viscosity that eliminate the scratches and surface defects created by previous mechanical operations, without creating scratches or defects in the Superfinished surface that is produced."

Superfinish is produced on any machined part in an extremely short time. Where the removal of scratches and surface defects is not desired beyond a limit of 3 micro-inches, the operation requires only from 3 to 30 seconds on ordinary parts. Briefly described, the finish is produced by stones, similar to those used in honing, that are given three or more simultaneous motions; a rapid oscillating motion of an amplitude of only 1/8 or 3/16 inch is always involved.

The pressure for producing Superfinish is strictly limited. It may be a few ounces and never more than a few pounds. This pressure is usually applied progressively; the operation is started with a very light pressure that is gradually increased, as nearly as possible, in proportion to the increased area of contact between the stones and the worn-off ridges on the material to be finished. While the stones used for finishing are the ordinary abrasive



Machine for Superfinishing the Main Bearings on Chrysler Camshafts

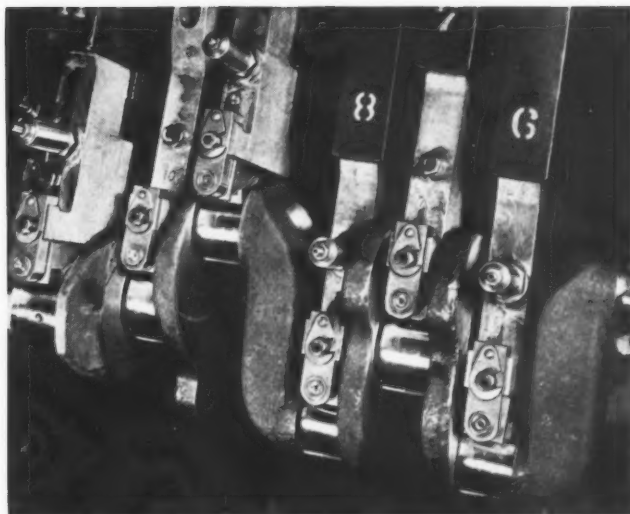


Six-spindle Centerless Type Piston Superfinishing Machine with Automatic Work Feed

stones, it is important that they should be well made and of suitable grain and hardness for the work to be done. A fine stone is not required unless a very perfect surface is desired. By a "very perfect" surface is meant one in which the surface defects are less than 1 micro-inch in depth.

A lubricant is used for washing away the fine cuttings from the Superfinishing operation. This lubricant is one of the most important elements in obtaining the desired results, since it must be of sufficient viscosity so that, when the proper finish has been obtained, it will create a film that will not be disrupted by the slight pressure of the stones on the work. In other words, when the pressure on the stones and the viscosity of the oil are properly adjusted with regard to each other, a point will be reached when there is practically no further wear or removal of metal, even though the motions of the abrasive stones were continued. This means that Superfinish applied to a surface already finished by grinding does not remove sufficient material to make an appreciable change in the diameter or dimensional size of the part, certainly not more than 0.0002 or 0.0003 inch.

By Superfinishing, the minute surface ridges of previous mechanical operations are practically removed to the point where the smooth base metal is reached. A surface so finished, when in contact with a similarly finished surface, properly lubricated, has shown no wear in tests to which it has been submitted. As microphotographs indicate, two parts with scratches on the surfaces are in contact only at areas aggregating a small percentage of the surface. The surface scratches hold the surfaces apart and contribute to the rupture of the oil film under heavy pressure, bringing about metallic contact, which, in turn, produces heat and causes material to be worn off. In time, the material so worn off serves as an abrasive and creates further wear. Superfinished surfaces, having no such ridges to wear off, are, however, practically immune to wear, which is one of the important



Close-up of Crankshaft in Machine Shown Below, Ready for the Superfinishing Operation

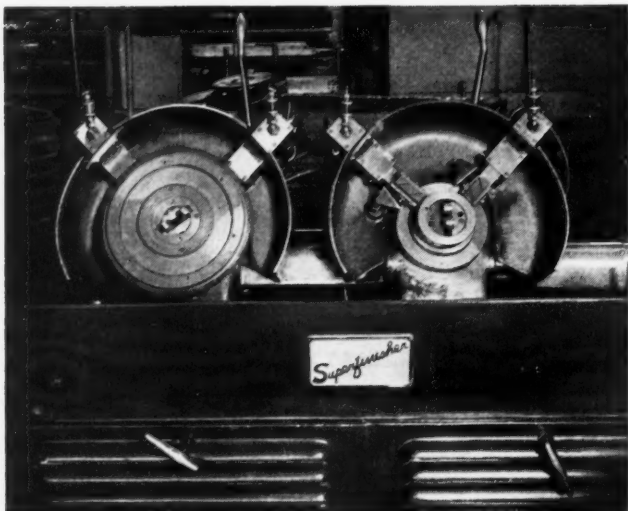
advantages claimed for this new method of finishing surfaces.

The illustrations on pages 858 and 859 show microphotographs indicating the finish that may be obtained by the Superfinishing method. Parts that are commercially Superfinished in the building of Chrysler cars are also shown. These include valve stems, piston-pins, pistons, valve tappet heads, brake-drums, brake-shoes, camshafts, crankshafts, and the clutch contact surface of flywheels.

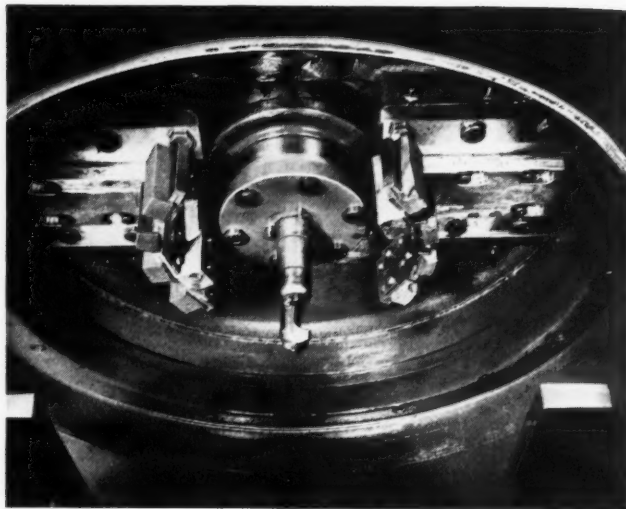
Several of the machines on which these finishing



Machine for Superfinishing Crankshafts. All Main and Pin Bearings are Finished at Once



Flywheel Superfinishing Machine. To the Left is Shown the Flywheel in Position for the Operation



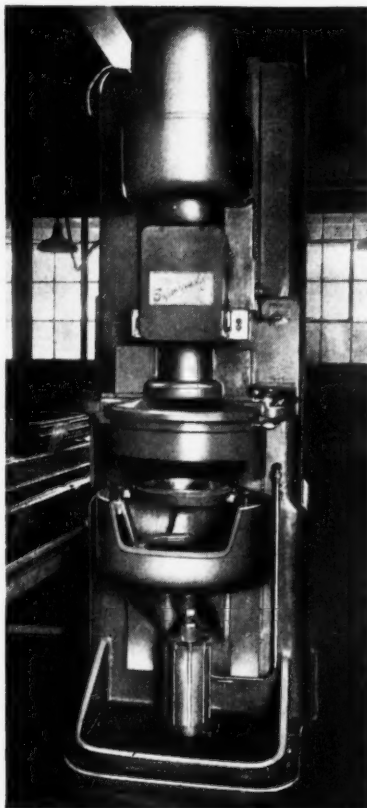
Looking Up Toward the Spindle of the Brake-drum Machine, Showing the Roughing and Finishing Stones

operations are performed are also illustrated. The machine for finishing the valve stems produces Superfinish on thirty-three pieces in 14 seconds. The internal cylindrical surface of the brake-drum is finished to a Superfinish of from 4 to 6 micro-inches in 10 seconds. The side of a flywheel is finished to a 10 micro-inch finish in 30 seconds. The crankshaft bearings are finished to 5 or 6 micro-inches in 30 seconds. In several instances, if there is sufficient production, this superior finish can be obtained without additional cost, because the operation prior to that of Superfinishing can be performed in a much easier manner than would be otherwise permissible.

* * *

Recognizing the importance of X-ray and radium inspection of engineering structures, the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has recently organized a committee on radiographic testing known as Committee E-7. The committee membership includes producers of engineering structures subject to X-ray inspection, users of such products, and makers of X-ray apparatus and radium supplies and equipment, as well as research workers. The primary purpose of the committee is to place radiography on a wholly practical industrial basis.

Single-spindle Vertical Brake-drum Superfinishing Machine, Showing Drum in Loading Position, Ready for Raising it to the Spindle



Lincoln Arc Welding Foundation's Jury of Awards Meets

The jury appointed to judge the papers submitted in the \$200,000 award program of the James F. Lincoln Arc Welding Foundation met at Cornell University, Ithaca, N. Y., for the purpose of passing upon the submitted papers. Thirty jurors from the engineering departments of well-known colleges and universities are judging the entries under the direction of Dr. E. E. Dreese of the Ohio State University, chairman of the jury of awards.

The contest, as will be recollected, was announced about fifteen months ago and covers the application of the arc-welding process of construction to the design of all types of products and structures. The papers will be judged on the basis of the benefits accruing to industry and to the public in general from the application of this industrial process. There are 446 prizes in the contest, ranging in amounts up to \$10,000, with a grand award of \$13,700. It is expected that the announcement of the winning papers will be made about the middle of September.

* * *

The National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill., has published four pamphlets relating to accident rates, respectively, in the metal products, foundry, steel, and non-ferrous metals industries, giving complete statistical information in regard to accidents in these industries in 1937.

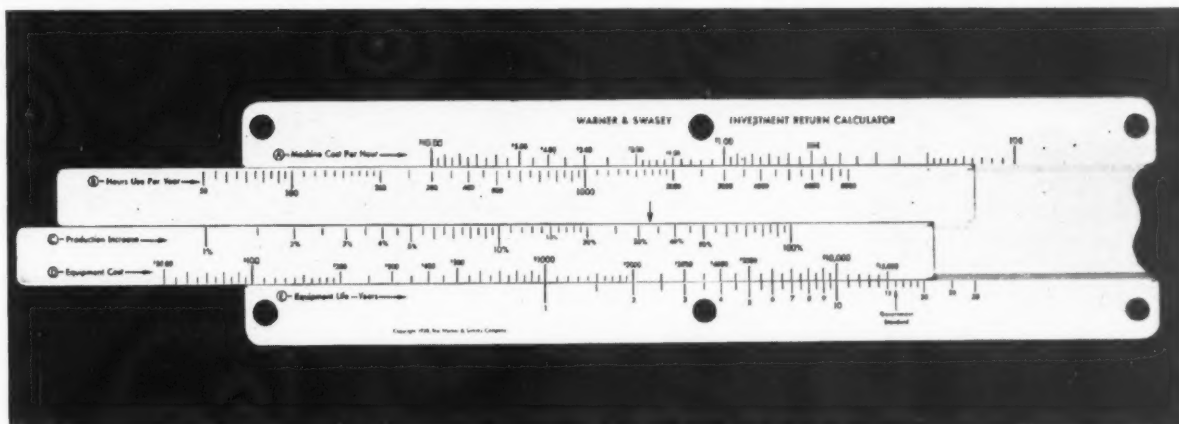
Warner & Swasey Calculator Simplifies Equipment-Buying Problems

WHEN the purchase of new machine tools is suggested to a prospective customer, the inevitable question that arises is "Will this installation be justified on a dollars-and-cents basis?" To answer this question, it is not only necessary that certain facts be known, but a calculation is involved requiring considerable work.

Let us take a typical problem. In an aircraft plant, tests have proved that a new turret lathe will increase the hourly production by 33 1/3 per cent. The purchase price of the new machine is \$3500. It is estimated that it will be operated 2000

solving such problems. The result was the invention of a new slide-rule type calculator, shown in the accompanying illustration. This slide-rule is to be distributed to the company's customers. It answers the questions involved in a few seconds.

The solution to the first problem is set up on the slide-rule in the illustration. The hours the machine is used per year, 2000, is set on scale *B* opposite \$1.50 (the machine cost per hour) on scale *A*. The production increase of 33 1/3 per cent is set on scale *C* opposite the arrow. The answer to the problem is found on scale *E*, under the equipment



The Warner & Swasey Slide-rule Calculator for Solving Problems Arising in Connection with the Contemplated Purchase of New Equipment

hours per year. The machine operating costs are \$1.50 per hour. In how many years will this new machine pay for itself? To get the answer, one must figure the annual cost of operating the new machine, then figure the annual savings based on a 33 1/3 per cent production increase, and then divide this figure into the cost of the new machine.

Let us take a second example. In making short shafts, a new multiple-cutter turner will increase the number of parts machined in an hour by 45 per cent. The new tool costs \$120; it will be used only 200 hours a year. If the cost of operation is \$1.25 per hour and it is expected that the new tool should pay for itself in two years, is its purchase price justified? The solution of this problem involves figuring the hours saved per year by the new tool, and the equivalent of this saving in dollars; then, by dividing this annual saving into 120, one will find how soon the new tool will pay for itself.

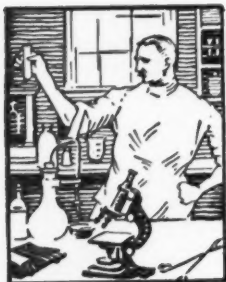
Inevitably, calculations of this kind consume a great deal of time and effort. To help overcome this difficulty, the Warner & Swasey Co., Cleveland, Ohio, endeavored to work out some plan for easily

cost figure of \$3500 on scale *D*. The answer as read on scale *E* is that the machine would pay for itself in three and one-half years.

The solution of the second problem is found in the same way. The 200 figure, the number of hours per year the new tool would be used, is set on scale *B* under \$1.25, the machine cost per hour. The production increase of 45 per cent is set on scale *C* opposite the arrow. Opposite \$120 on scale *D* is the answer on scale *E*—the new multiple-cutter turner would pay for itself in less than two years, which, in line with the company's policy, would justify its purchase. Thus, by the aid of the calculator, with any four factors known, the fifth can be immediately determined.

With the need for modern, up-to-date equipment more important than ever, the new calculator provides the executive for the first time with a quick and simple means of determining whether or not a new machine tool installation is desirable. It provides him with a short-cut in answering the inevitable question, "Is the installation justified on a dollar-and-cents basis?"

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES



Glyptal Preparation Prevents Adhesion of Weld Spatter

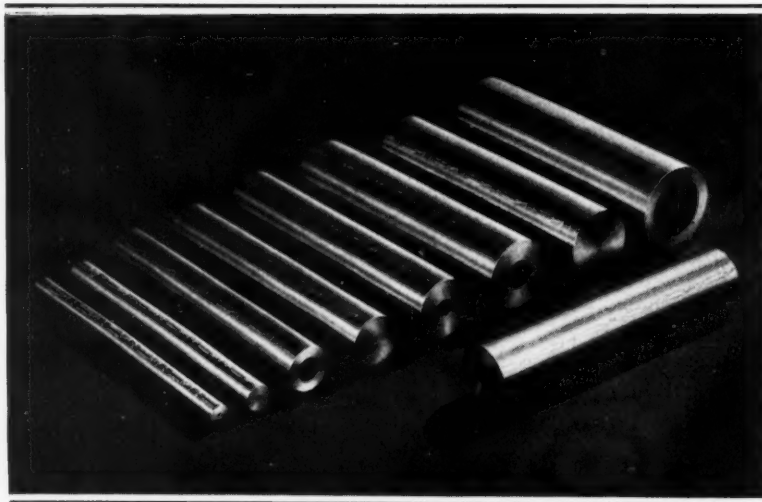
A material known as Glyptal No. 1294 has been announced by the General Electric Co., Schenectady, N. Y., for preventing the adhesion of weld spatter to metals which are to be welded. This material can be used without harm on any metal surface, including polished stainless steel. It will not make a weld hard or brittle.

In applying this Glyptal preparation, spraying is preferable to brushing because the former method insures a thinner coat. A thin coating will protect the work as well as a thick coating if the surface is completely covered, is more economical, and dries faster. On surfaces which are to be painted, this material serves as an excellent priming coat. It prevents the forming of rust on steel in storage.

The preparation will withstand temperatures up to 600 degrees Centigrade (1112 degrees F.) for 1/2 hour. At the end of this period the preparation will begin to evaporate.....201

Machined Cored and Solid Bronze Bars

A line of cored and solid bronze bars, known as "Precision Bronze Bars," has been placed on the market by the Bunting Brass & Bronze Co., Toledo,



Ohio. These bars are cast from Bunting No. 72 or S A E 660 specifications, which contain 83 per cent copper, 7 per cent tin, 7 per cent lead, and 3 per cent zinc.

The bars are produced by a casting method which is said to produce a uniform metallic structure regardless of diameter or wall thickness. Anti-frictional and wear-resisting properties are particular features. The bars are machined both on the outside and in the cored holes.

Enough stock is left on the diameters to finish bearings to the size that is stamped on the bar. The supplying of these bars in the finished state reduces machining time in the user's shop and minimizes waste. The bars are made in 13-inch lengths. Over 240 sizes are carried in stock at the Toledo factory and at warehouses throughout the country.202

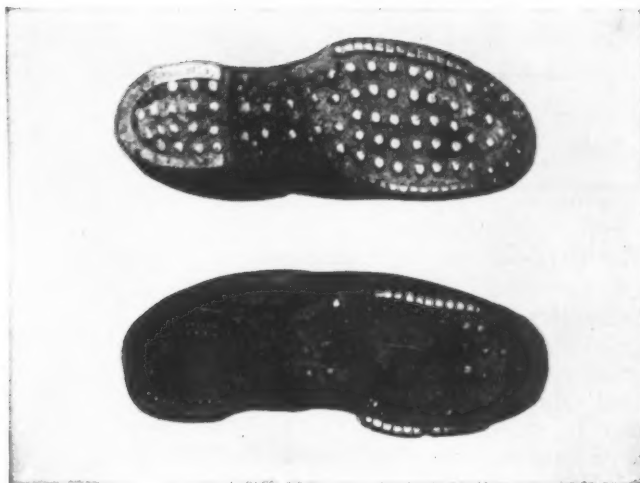
Additional Uses of Glass Fabric

A new Bakelite laminated material, in which woven glass fabric is used in place of the customary paper or fabric base, has been announced by the Synthane Corporation, Oaks, Pa. Tests have shown that the glass fabric gives an unusually low moisture absorption to laminated phenolic resinoid materials. Other advantages are a minimum change in electrical characteristics and increased resistance to the action of corrosive liquids.

Glass-cloth anode bags are now obtainable from the Hanson-Van Winkle-Munning Co., Matawan, N. J., for use in electroplating operations. This bag of glass cloth, which was developed in cooperation with the Corning Glass Co., is of one-piece tubular construction. It is sealed by a special process at one end and protected from raveling at the

Cored and Solid Bronze Bars,
Machined Inside and Outside
Carried in Stock by the Bunting
Brass & Bronze Co.

A Conclusive Demonstration of the Value of Hard-facing. How Hard-faced Hob Nails Prolong the Life of Miner's Shoes is Apparent from the Illustration, which Shows Two Shoes after Six Months' Wear. The Top Shoe was Provided with Hard-faced Hob Nails and Neither the Leather Soles nor the Hob Nails Show Signs of Wear. The Bottom Shoe was Provided with Ordinary Hob Nails. Photo, Courtesy of The Linde Air Products Co.



other end. The bag is flexible, will greatly outlast an ordinary cloth bag, and does not require any more care than if it were made of strong parchment paper. This glass-cloth bag is recommended for all acid solutions and for many kinds of alkaline solutions.

Magnet wire covered with glass has been placed on the market by the Anaconda Wire & Cable Co., 25 Broadway, New York City, under the trade name of Vitrotex. In appearance the glass-covered wire resembles silk. It has the ability to withstand high temperatures for long periods of time and has a high dielectric strength and insulation resistance. Vitrotex wire can be wound into coils by following the same general methods used with other magnet wires. The tape covering, the flexible lead insulation, and the insulation on the magnet wire are of glass cloth.203

Resin Solution for Increasing the Density of Castings

A solution of specially formulated resin, which has been used by several foundries for a few years to increase the density of certain types of castings, has now been made commercially available by General Plastics, Inc., North Tonawanda, N. Y. Often the foundry is called upon to cast an alloy of a specification that is necessary for reasons of chemical resistance but which cannot be readily cast into a solid non-porous structure. Occasionally, also, the necessary design of a casting may present difficult shrinkage problems.

Slight porosity of castings resulting from these causes can be successfully overcome and the casting made tight by the use of this No. 278 resin solution. Proper impregnation is made by applying pressure, or by both vacuum and pressure. After impregnation, the casting is baked at a temperature of 250 degrees F. or higher, in order to set the resin. When hardened in this manner, the resin is practically unaffected by water, solvents, mild alkalis, and acids. This treatment is costly but has proved advantageous in eliminating the

rejection of expensive castings due to porosity discovered after the performance of machining operations.204

Rubber Paint Withstands Severe Tumbling Test

In order to determine the durability of Surfaseal rubber paint, the protective coating manufactured by Collord, Inc., Detroit, Mich., a tumbling barrel coated on the interior with this paint was run for over 500 hours half filled with crushed stone. At the end of this period the only worn areas were on welded ridges. In preparing the tumbling barrel for this test, the interior was sand-blasted and then a Surfaseal primer was applied. After the primer had dried, Surfaseal No. 2 was brushed on. Seven coats were applied twenty-four hours apart...205

Nickel Equalizes Hardness and Density in Castings

Where castings of irregular sections are required, it is obviously impossible to obtain an ordinary cast iron in which a 1/4-inch section attains maximum density without an adjacent 1 or 2 inch thick portion becoming open-grained. It is, however, according to A. G. Zima, of the International Nickel Co., possible to minimize this wide difference in structure by reducing the silicon content to a point where the heavy section attains the required density, and then adding nickel to prevent the thin sections from becoming white, brittle, and un-machineable. Castings subjected to pressure, such as those used for valves, pumps, compressors, and engines, are frequently alloyed with nickel in this manner to insure uniform density and pressure tightness. Gear blanks, couplings, pistons, pulleys, sprockets, and other castings of non-uniform sections are likewise alloyed with nickel or nickel-chromium to bring about uniform hardness and machineability.206

To obtain additional information about materials described on this page, see lower part of page 870.

NEW TRADE



LITERATURE

Metal Moldings and Shapes

DAHLSTROM METALLIC DOOR CO., Jamestown, N. Y. Profusely illustrated 167-page catalogue showing actual-size section drawings of a great number of shapes that the company is producing from practically all of the commonly used metals, for use in the fabrication or assembly of all types of sheet-metal products. Design and production men alike will find this book a useful source of information. 1

Molybdenum Steel

CLIMAX MOLYBDENUM CO., 500 Fifth Ave., New York City. Loose-leaf binder containing thirteen sections, together with a general index, of a treatise entitled "Molybdenum in Steel," covering the subject completely from every engineering angle and containing a wealth of data on physical properties, compositions, and applications of molybdenum steels. 2

Cold-Drawn Steel

UNION DRAWN STEEL DIVISION OF THE REPUBLIC STEEL CORPORATION, Massillon, Ohio. Illustrated handbook entitled "Cutting Costs with Cold-Drawn Steel," calling attention to the advantages of cold-drawn steel in lowering costs of manufacture. The booklet is designed to serve as a guide in the selection of materials for a variety of applications. 3

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-1724A, "Controllers for Synchronous Motors"; GEA-2026A, "Alternating-Current Brake-Motors"; GEA-2966, "Sheath-Coated Electrodes for Cast-Iron Welding"; GEA-2965, "Thinly Coated Electrodes for High-Speed Arc Welding"; GEA-2791A, "Thyatron Resistance-Welder Controls." 4

Press-Room Equipment

U. S. TOOL COMPANY, INC., Amepere, East Orange, N. J. Bulletin No. 20, illustrating and describing the company's automatic press-room equipment, including slide feeds, roll

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 869 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the August Number of MACHINERY

feeds, stock oilers, power-driven straighteners, stock straighteners, two-way wire straighteners, stock reels, and coil cradles. 5

Grinding Machines

LANDIS TOOL CO., Waynesboro, Pa. Catalogue J-38, illustrating and describing the company's 10- by 24-inch Type C hydraulic universal grinder, covering the construction in detail and illustrating many typical operations. Catalogue J-138, describing the 12-inch Type C hydraulic universal grinder. 6

Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Bulletin 35-600 entitled "Network Protectors"; Bulletin 31-260, "Silverstat Direct and Quick-Acting Generator Voltage Regulator"; Bulletin 43-137, "Portable Current Transformer"; and Bulletin 43-131, "Portable Voltage Transformers." 7

Nickel Cast Iron

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Booklet entitled "Nickel Cast Iron Data," prepared as a guide for the selection of engineering specifications for gray cast iron to secure density, hardness, toughness, wear resistance, strength, rigidity, machineability, and reduction of chill. 8

Broaching Machines

AMERICAN BROACH & MACHINE CO., Ann Arbor, Mich. Folder illustrating and describing the American

Type T 3-way vertical hydraulic broaching machine, which meets the demand where a universal machine is required, as it is easily changed from one type of operation to another. 9

Tubing

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. A 24-page booklet, "Timken Mechanical Tubing," explaining in detail the variety of industrial uses for Timken tubing. Physical properties, tolerance charts, and other data of value to users of seamless tubing are included. 10

Flame Hardening

THE LINDE AIR PRODUCTS CO., 205 E. 42nd St., New York City. Booklet entitled "Flame Hardening," describing the process whereby the surface of an iron or steel product is locally heated by means of the oxy-acetylene flame and then hardened by rapidly quenching in water. 11

High-Tensile Steels

CARNEGIE-ILLINOIS STEEL CORPORATION, 434 Fifth Ave., Pittsburgh, Pa. Booklet entitled "Deadweight is Off the Payroll with U.S.S. High Tensile Steels," describing the properties and applications of the steels known by the trade names "Cor-Ten," "Man-Ten," and "Sil-Ten." 12

Heat-Treating Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Catalogue T-624, "Homo Method for Nitriding," illustrating and describing in considerable detail the Homo method for obtaining a uniformly nitrided case of specified hardness and depth. 13

Variable-Speed Control

REEVES PULLEY CO., Columbus, Ind. Catalogue G-384, entitled "Reeves Variable Speed Control." In this 124-page catalogue the complete line of Reeves variable-speed control equipment is fully covered with specific information profusely illustrated. 14

Welding Equipment

LINCOLN ELECTRIC Co., Cleveland, Ohio. Folder entitled "Air Conditioning for Lower Welding Costs," illustrating and describing the "Lin-conditioner" for improving working conditions. The new equipment filters the smoke and removes the heat of welding operations. 15

Threading Equipment

LANDIS MACHINE Co., INC., Waynesboro, Pa. Folder entitled "Here's One Way for Your Plant to Make a Profit Now." The folder quotes specific instances of reduced costs through the use of Landis threading machines, die-heads, and collapsible taps. 16

Roller Bearings

LINK-BELT Co., 307 N. Michigan Ave., Chicago, Ill. Booklet No. 1652, giving dimensions, weights, load ratings, engineering data, and list prices of Link-Belt Shafer radial-thrust single-row and double-row roller bearings in unmounted form. 17

Screwdriving and Nut-Setting Machine

STOW MFG. Co., INC., Binghamton, N. Y. Circular illustrating and describing the company's new screwdriving and nut-setting machine. This equipment can also be arranged with proper speeds for grinding, polishing, etc. 18

Grinding and Polishing Machines

EXCELSIOR TOOL & MACHINE Co., East St. Louis, Ill. Circular 27-E, illustrating and describing automatic twin-spindle grinding and polishing machine for flat surfaces, applicable to many industrial grinding and polishing operations. 19

Milling Machines

CINCINNATI MILLING MACHINE Co., Cincinnati, Ohio. Catalogue No. M-796, entitled "Cincinnati Vertical Hydro-Tel Milling Machine," illustrating and describing in detail the construction and application of this line of machines. 20

Surface Grinding Machines

BLANCHARD MACHINE Co., 64 State St., Cambridge, Mass. Booklet entitled "Work Done on the Blanchard," containing over 100 illustrations with production data, showing work done on Blanchard surface grinding machines. 21

Pneumatic Tools

CLEVELAND PNEUMATIC TOOL Co., 3734 E. 78th St., Cleveland, Ohio. Bulletin L, illustrating and describing the company's No. 9 series of rotary air drills, grinders, screwdrivers, and nut-setters. 22

Flexible Couplings

POOLE FOUNDRY & MACHINE Co., Woodberry, Baltimore, Md. Catalogue

No. 38 entitled "Flexible Couplings, Their Value and Many Advantages," covering in complete detail the couplings made by the company. 23

Oilless Bearings

BOUND BROOK OIL-LESS BEARING Co., Bound Brook, N. J. The first number of a publication entitled "The Reservoir," intended for engineers in general, and designing engineers in particular, who are dealing with bearing problems. 24

Stainless Steel

SMITH STEEL FOUNDRY Co., 1320 S. 1st St., Milwaukee, Wis. Two pamphlets entitled, respectively, "Condensed Data on Corrosion-Resistant Stainless Steels" and "Corrosion Resistance of 18-8 Stainless Steel to Various Media at 70 Degrees F." 25

Hydraulic Slotters

ROCKFORD MACHINE TOOL Co., Rockford, Ill. Four-page folder illustrating and completely describing the company's Hy-Draulic slotter, 20-inch rating, 36-inch stroke, listing features and specifications. 26

Soldering-Iron Temperature Control

ELECTRIC SOLDERING IRON Co., INC., Deep River, Conn. Circular illustrating and describing a thermostatic control stand for maintaining soldering irons at any desired temperature. 27

To Obtain Copies of New Trade Literature

listed on pages 868-870 (without charge or obligation) mark with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44

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MACHINERY, August, 1938—869

Automatic Screw Machines

BROWN & SHARPE MFG. Co., Providence, R. I. Bulletin entitled "It Pays to Replace Old Automatic Screw Machines with Brown & Sharpe Machines of New Design." The bulletin gives the reasons.....28

Contour Measuring Projector

BAUSCH & LOMB OPTICAL Co., Rochester, N. Y. Catalogue D-27, entitled "Contour Measuring Projector," illustrating and describing in great detail the construction and use of this device.....29

Ball Bearings

NORMA-HOFFMANN BEARINGS CORPORATION, Stamford, Conn. Circular entitled "Extra Protection for Self-Sealed Bearings," dealing with two features that contribute toward better bearing service.....30

Expansible Reamers

BARBER-COLMAN Co., Rockford, Ill. Circular entitled "Pinwedge Positive Adjustable Expansible Reamer," illustrating and describing the construction and applications of this type of reamer.....31

Safety Equipment

LEHIGH SAFETY SHOE Co., INC., Allentown, Pa. Booklet illustrating and describing the Lehigh safety shoe for industrial workers for preventing foot injuries from falling weights, etc.....32

Monel Metal

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City. Booklet relating to the application of Monel in the construction of steam specialties to give long service.....33

Portable Electric Grinders

WODACK ELECTRIC TOOL CORPORATION, 4627 W. Huron St., Chicago, Ill. Circular illustrating and describing portable electric grinders and special grinding and abrasive cutting machines.....34

Riveters

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago, Ill. Catalogue No. 227, illustrating and describing squeeze riveters and showing many examples of their application.....35

Spring-Making Machines

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squares below, the identifying number found at the end of each description on pages 871-887 — or write directly to the manufacturer, mentioning machine as described in August MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94

Fill in your name and address on other side of this blank.

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Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Full-Universal Hy-Draulic Slotter

Hydraulic drive and feeds are outstanding features of a slotting machine recently developed by the Rockford Machine Tool Co., Rockford, Ill. Various advantages are claimed for the application of hydraulic power to this type of machine. For example, power is applied directly to the ram in a straight line close to the ram bearings. The speed and pressure of the ram operation are constant throughout the cutting stroke. Reversals are accomplished quickly without shock. The return ratio is not subject to the limitations of mechanical drives and is therefore higher. Coasting when the machine stops is prevented by the hydraulic drive.

There is an unlimited selection of feeds and speeds throughout the whole range of the machine by means of a simple adjustment. Cutting tools can always be operated at maximum capacity with ease. Changing the ram stroke and the position of the ram relative to the work is easily accomplished without using tools or altering the cutting speed. Vibration and other causes of marks on machined surfaces are eliminated, and tool life is prolonged. The regular lubricating system is supplemented by the latest type of one-shot pressure systems.

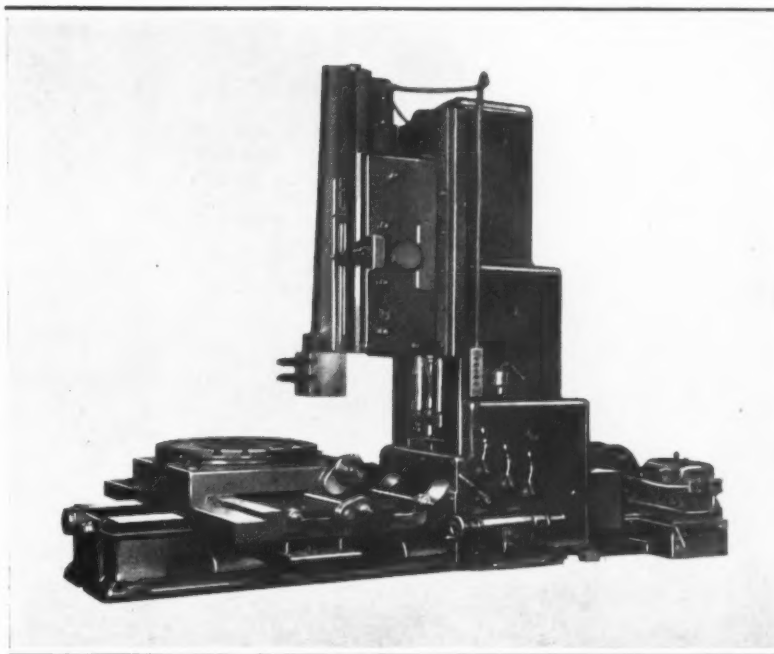
This Hy-Draulic slotter has a rated size of 20 inches. The maximum length of stroke is 36 inches and the minimum length, 6 inches. The machine will work to the center of a circle 83 inches in diameter. The hydraulic pumping unit is located at the rear of the column and is connected to

the machine-actuating elements with minimum piping that may be readily inspected. The standard type, constant-speed driving motor is accessible and is direct-connected to the pumping unit.

In the full-universal slotting machine shown, the ram guide has a vertical adjustment and power elevation. Clamps lock the ram guide securely in any adjusted position and insure alignment. The ram may be tilted forward any amount up to 10 degrees, graduations showing the amount of inclination. The longitudinal hand adjustment and power rapid traverse of the saddle may be operated from either side of the machine.

There is a built-in dividing head for accurately indexing the table in cutting gears, spacing keyways, and performing similar work. This dividing head can be disengaged when not in use.

Hydraulic feed is provided in longitudinal, transverse, and rotary directions. Near the hydraulic feed control are four levers, one for engaging the feed and power rapid traverse of the cross-slide, another for engaging the longitudinal feed and power rapid traverse of the saddle, the third for engaging the rotary hydraulic feed and power rapid traverse of the table, and the fourth for starting and stopping the ram. 51



Full-universal Rockford Hy-Draulic Slotter with Adjustable Ram Guide and Tilting Ram

SHOP EQUIPMENT SECTION

Carlton Radial Drill with 26-Inch Column

A radial drilling machine with a 26-inch column, which can be furnished with an 8-, 9-, 10-, 11-, or 12-foot arm and to take work of any height desired between the base and the spindle, has been brought out by the Carlton Machine Tool Co., Cincinnati, Ohio. This machine can be furnished with any type of table or base required for production work. It has sufficient power and a suitable range of speeds and feeds for handling 10- and 12-inch tapping work, as well as sufficiently high speeds and feeds for performing drilling operations with drills as small as 1/4 inch in diameter.

The design of this machine is similar to that of the regular radial drills made by this company, one of which is shown on the base of the large machine in the accompanying illustration. The ball-bearing head rolls around the arm on a hardened steel way. Forced lubrication is provided for the head.

Power rapid traverse is furnished to the head by an individual motor operated through

a push-button control. There is also a motor for raising or lowering the arm, as well as a motor for locking the arm on the column. All the motors are controlled by push-buttons on the head. There is an electric-hydraulic column clamp, which is

also operated by a push-button located on the head of the machine.

In addition to the set of push-buttons mounted on the head, there is another set on the skirt of the column. This permits the machine to be operated from the floor when the arm is in a high or raised position. 52

Rickert-Shafer Double-Spindle Tapping Machine

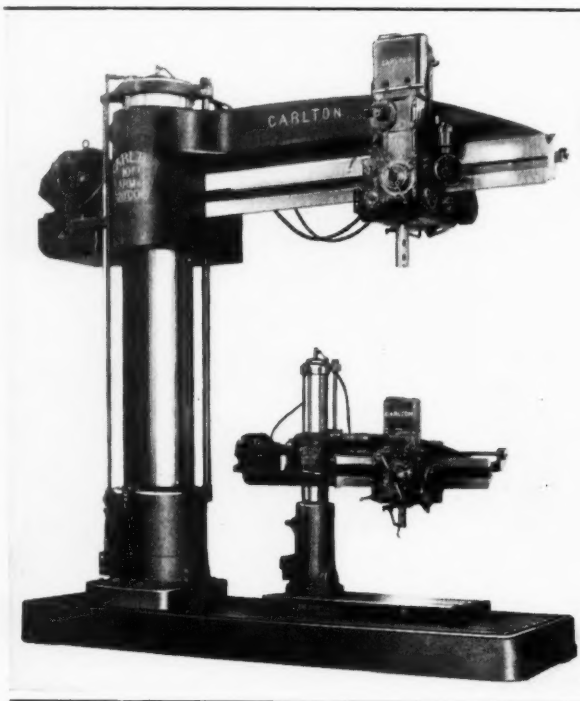
The tapping and external threading of both ends of rods, tubes, and similar work can be done economically on a double-spindle machine recently brought out by the Rickert-Shafer Co., Erie, Pa. The machine shown in the accompanying illustration is equipped with taps. For external threading, the taps can be replaced by solid dies or self-opening die-heads.

Automatic feed, through chutes or magazines, can be provided for many pieces, depending on their shape and size, so that the operator only has to keep the magazines filled. The fixture on the machine illustrated is indexed after each tapping opera-

tion to bring two new pieces of work into the proper positions for tapping. 53

Lincoln Electrode and "Spatter-Film"

The Lincoln Electric Co., Cleveland, Ohio, has announced a new electrode for use in the construction of pressure vessels from steels having a tensile strength ranging from 70,000 to 80,000 pounds per square inch. This electrode is suitable for welding deep-groove joints and produces welded metal that has extra strength and creep resistance at



Carlton 26-inch Column, 10-foot Arm Radial Drill
Shown with a 4-foot Arm Machine



Two-spindle Tapping Machine Built by the
Rickert-Shafer Co.

SHOP EQUIPMENT SECTION

elevated temperatures. The electrode can be used with either alternating or direct current. It is intended for welding in a down or flat position only.

The physical properties of "Fleetweld No. 9-HT" weld deposits, stress relieved at 1200 degrees F., are approximately as follows: Tensile strength, from 70,000 to 76,000 pounds per square inch; yield point, from 58,000 to 63,000 pounds per square inch; and elongation in 2 inches, from 27 to 32 per cent. This electrode is made in 3/16- and 1/4-inch sizes and in 18-inch lengths.

A new compound has been brought out by the same company which is claimed to reduce cleaning time after welding by 20 to 60 per cent. This compound, known as "Spatter Film," has been developed to increase the economy of electric welding as a process of manufacture and fabrication. A thin film of the compound is applied with a brush to the work adjacent to the seam or joint to be welded. It is particularly adapted for use where painting and finishing are essential after welding. It can be re-

moved readily before painting by wiping with a clean cloth when still wet, or by washing with

water if the coating is dry. A gallon of compound will cover about 50,000 square inches.54

Brown & Sharpe Universal and Plain Milling Machines

Two light type milling machines have recently been added to the line manufactured by the Brown & Sharpe Mfg. Co., Providence, R. I. These new machines, a No. 2 universal and a No. 2 plain milling machine, are both equipped with "power fast travel." The outstanding features are moderate weight, ease of handling, and ample rigidity. In addition, power fast travel is obtainable in all feeding directions at the rate of 76 inches per minute by merely touching a switch button at the front of the machine knee. When the button is released the table resumes its original feeding movement. The fast feed is provided by a totally enclosed constant-speed motor built into the right side of the knee. The power fast travel, being independent of both spindle and table feed drives, is available at all times.

The handwheels for obtaining the transverse and vertical adjustments are each automatically disengaged when power feed in the respective direction is engaged. A safety hand-crank is provided for making longitudinal adjustments. The mechanism in the knee is lubricated by an automatic system, while the table driving mechanisms, table ways, and bearing surfaces at the top of the knee are lubricated at each movement of the lever that engages the longitudinal feed.

The one-piece knee-screw is enclosed in a telescoping guard and is automatically lubricated. All feeds are automatic, the longitudinal feed being 28 inches, the transverse feed, 10 inches and the vertical feed, 15 inches. The universal machine will take work 28 inches in length and the centers will swing work 10 inches in diameter.55

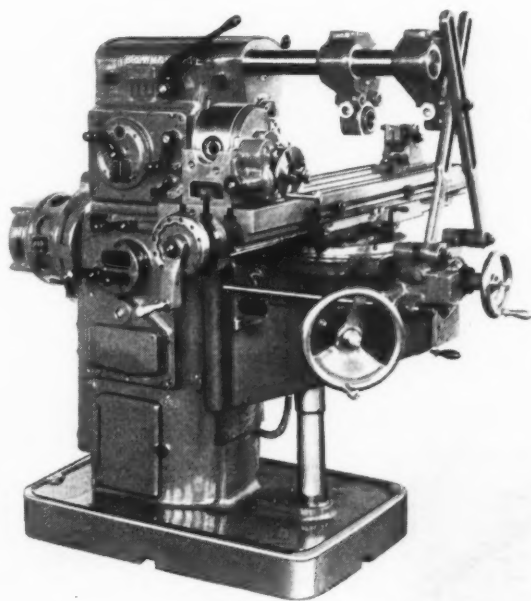


Fig. 1. Brown & Sharpe Light Type Universal Milling Machine with Power Fast Travel

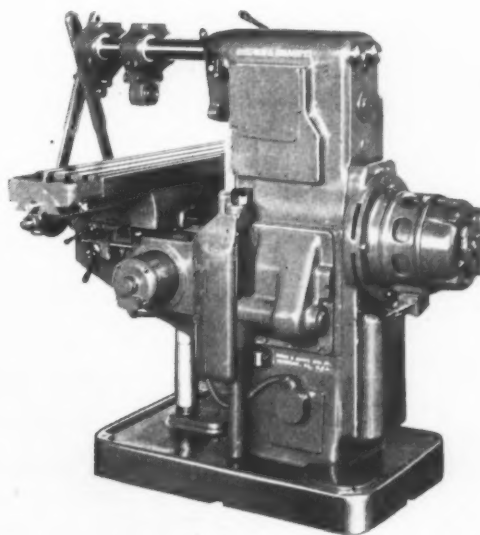
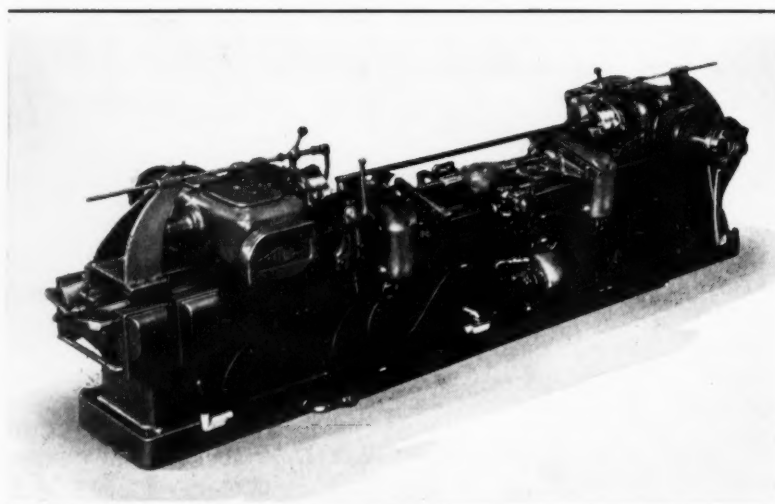


Fig. 2. Brown & Sharpe Light Type Plain Milling Machine with Power Fast Travel



Hydraulically Operated Double-end Threading Machine Built by the Landis Machine Co.

"Lanhydro" Double-End Threading Machine

The Landis Machine Co., Inc., Waynesboro, Pa., has recently added a double-end threading machine, known as the "Lanhydro," to its line of equipment. This unit will cut threads simultaneously on both ends of tie-rods, short bars, etc.

The work to be threaded is placed on supports in the open gripper jaws with the end against a stop. The main control valves are then operated by means of a hand-lever, thus closing the gripper jaws. The work-stop then withdraws and both threading units advance rapidly to a point where the chasers just clear the ends of the work. At this point the threading feed is engaged and continues to feed the units for the duration of the operation. Upon the completion of the threading operation, the opening action of the die-head shifts a valve, which causes the threading units to return at high speed to their original positions.

The return movement of the threading units closes the die-heads automatically and operates the valve which opens the gripper jaws. The work ejector cylinder is actuated by the opening of the gripper jaws. Following this movement, the work-stop is lowered. The entire hydraulic system is so interlocked that no movement, such as opening the

gripper jaws or ejecting the work, can take place before each preceding movement in the cycle is completed. Ejector arms, located between the work supports, operate through an arc of 90 degrees and permit the work to roll down two inclined rails to a chain conveyor which piles the work on truck platforms.

Through a special pressure-control valve the threading units can be advanced under pressure at a definite feeding speed for the full length of the thread. This arrangement results in very accurate control over the thread lead.

The spindle speed of each threading unit is independently controlled by pick-off gears. The machine shown has a capacity for threading work from 1/2 inch to 2 inches in diameter and from 4 feet 2 inches to 6 feet 6 1/2 inches long. 56

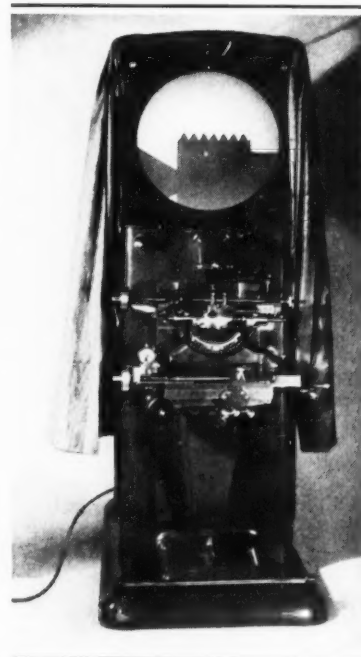
Bausch & Lomb Contour Measuring Projector

A contour measuring projector developed to meet the requirements of users and builders of precision machines and instruments has been brought out by the Bausch & Lomb Optical Co., Rochester, N. Y.

This projector is particularly adapted for the rapid measuring

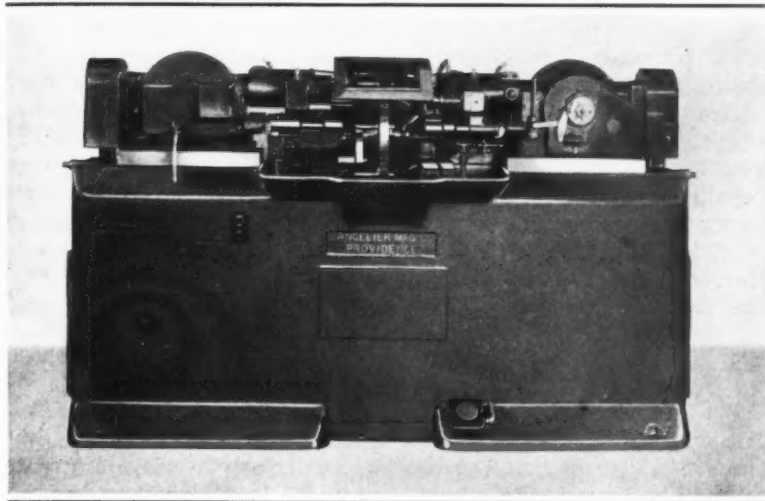
and inspecting of forming tool contours; cam forms; screw threads, thread plug gages, taps, lead-screws, chasers, hobs, thread ring gages (with sulphur cast attachment), and threading dies; forms of gear teeth; meshing action of a pair of gears; surface dimensions of jigs, dies, fixtures, etc.; form and dimensions of punches and dies; irregular-shaped production parts, plain and formed stampings, knurls, and face and back angles of bevel gear blanks; and parts of which specimens are at hand but for which no drawings are available.

Four projection lenses are regularly available, one for each of the following magnifications: 10X, 25X, 50X, and 100X. Other powers can be made on special order. These lenses are finely adjusted and can be interchanged without greatly disturbing the sharpness of the image on the screen. Only a slight adjustment is required to sharpen the focus after changing from one magnification to another. Various types of interchangeable screens are available to suit requirements. A protractor screen is shown in use in the accompanying illustration. 57



Bausch & Lomb Contour Projector Equipped for Thread-measuring

SHOP EQUIPMENT SECTION



Drilling and Tapping Machine Built by the Langelier Mfg. Co.,
for Drilling Fuse Bodies

Drilling and Tapping Machine for Fuse Bodies

The machine here illustrated was built for the Frankford Arsenal by the Langelier Mfg. Co., Providence, R. I., for performing multiple operations on the body of a mechanical time fuse for shells. It has four units, two being mounted in opposed positions and carrying auxiliary heads. The left-hand head has six spindles for drilling operations and the right-hand head has three spindles for counter-boring and one for end-milling. At the rear is a lead-screw feed

unit for tapping one of the holes previously drilled, and a single-spindle unit for drilling the hole in the periphery of the piece.

All units are interlocked electrically so that it is impossible to index the fixture unless the heads are in their proper positions. On moving the dial, the work is automatically unclamped, and at the beginning of the feed stroke an air valve is operated for ejecting the finished piece. The production averages 450 complete pieces per hour. 58

Universal Vertical Hydraulic Broaching Machines

A vertical hydraulic broaching machine built in two sizes, having normal capacities of four and six tons, has recently been developed by the American Broach & Machine Co., Ann Arbor, Mich. These machines have been designed primarily for use where different classes of work are broached in limited quantities and where it is desirable to make quick change-overs from one type of broaching work to another.

The machines can be easily and quickly changed over for any one of the following three types of operations: Push down internal broaching, pressing, or assembly work; pull down in-

ternal broaching; and surface broaching. The hydraulic cylinder, which is the moving part, is built integral with the machine slide or ram. This feature provides a long stroke with relatively low column and low loading height. The weight of the moving slide and cylinder affords a smooth, uniform cutting action.

Interchangeable work-table rest plates are employed for various types of broaching operations. One plate is furnished as standard equipment, which will accommodate the work-holding fixtures for internal broaching of the usual type. The Sundstrand hydraulic pumping unit is attached to the motor bracket and

is connected to the motor shaft through a flexible coupling. With this arrangement the pump is placed in the reservoir of the hydraulic system. The piston-rod is the fixed member and it is bolted to the top manifold which is supported by the upright column, thus the cylinder moves up and down on this rod on which the piston-head is assembled.

Lever type safety controls are employed, one on each side of the machine. The operator must place both hands on the levers for starting the machine on the broaching stroke, but only the lever on the right-hand side is used for the return stroke. The broaching speed on the downward stroke is 30 feet per minute for the smaller machine and 28 feet per minute for the larger machine. The return speeds for the two machines are 45 and 44 feet per minute, respectively. The maximum stroke on both machines is 24 inches. The maximum broach length for push down operations is 25 inches, and the maximum broach length for pull down broaching is 31 inches for both machines. The maximum work diameter capacity is 10 inches. 59



Broaching Machine Built by American Broach & Machine Co.

Thomson-Gibb Power-Driven Spot-Welder

A motor-driven spot-welding machine with all parts designed to stand up under constant operation in sheet-metal stamping shops, has been brought out by the Thomson-Gibb Electric Welding Co., 170 Pleasant St., Lynn, Mass. The G Series welder is available in three standard throat depths and four transformer capacities and with a speed range wide enough to suit the pace of any production line. The choice of throat depths is 12, 18, or 24 inches and the transformer capacities are 20, 30, 40, or 60 kilovolt amperes. The transformer is water-cooled in each size and is designed to operate continuously at full load without overheating.

Both arms are of hard rolled copper 2 1/2 inches in diameter. By reversing the arm-holder, the lower arm can be given a drop of either 5 1/2 or 14 3/4 inches. This arm can also be swung 30 degrees to either side of the center line. Pressure is supplied by a cam driven by a worm reduction unit acting on the rocker arm into which the upper welding arm is clamped. A hardened nut, which bears against the anti-friction thrust bearing, pro-

vides means for regulating the pressure from a minimum of approximately 200 pounds to a maximum of 800 pounds. Heat regulation is obtained with a five-point regulator.

Control of the current dwell is provided by a magnetic contactor, a limit switch, and an adjustable fan type cam which

operates in conjunction with the pressure cam. The drive mechanism is mounted on the head casting and consists of a worm reduction and clutch driven by a 1/2-horsepower motor at 1200 revolutions per minute through a pair of three-step V-groove pulleys. Speeds obtainable with the various pulley arrangements are 42, 53, 66, 81, 101, and 127 spots per minute. 60

Roth "Ultraspeed" Spot-Welding Equipment

A spot-welding method which permits welds to be made at the rate of 10 to 20 spots per second, has been developed by the Roth Welding Engineering Co., Inc., 17146 Mt. Elliott, Detroit, Mich. With this method, as many individual spot-welding electrodes as required are put under pressure simultaneously. Each electrode has a separate pressure spring and individual current connection. The welding current is supplied to the individual electrodes in rapid succession, at the rate of 10 to 20 shots per second, by a special current-distributing unit. After all the welds are finished, the pressure is released simultaneously.

Advantages claimed for this

method are: Extremely high speed; clean welds of greater strength and uniformity than previously obtained in production welding; small transformer capacity because only one electrode welds at a time; and individual electrodes that act as hold-down clamps and, to a certain extent, as forming dies.

From ten to several hundred electrodes may be incorporated in one machine for high-production assembling of sheet-metal parts and wire goods in various industries. In the automotive industry this machine is used for welding bodies and certain chassis parts as well as automotive accessories. Other applications are fabricated steel houses,



Thomson-Gibb Motor-driven Spot-welder



Roth "Ultraspeed" Spot-welding Machine

SHOP EQUIPMENT SECTION

household machinery, stoves, metal furniture, electric appliances, radios, refrigerators, air-conditioning equipment, airplane manufacturing, and assembly operations on railroad cars. To insure sufficient additional pro-

duction capacity to meet the demands for this new equipment, the Federal Machine & Welder Co., Warren, Ohio, has been licensed to produce "Ultraspeed" welders under the Roth Welding Engineering Co.'s patent.61

Lubrication of the spindle heads is furnished by a built-in pump and there is also a pump for supplying the tools with cutting lubricant.62

Newton Heavy-Duty Two-Spindle Boring Machine

Large cast-steel electric railway motor frames are bored and faced on a Newton heavy-duty two-spindle boring machine recently built by the Consolidated Machine Tool Corporation, Rochester, N. Y., for one of the large manufacturers of railway motors. As shown in the illustration, this machine consists primarily of two unit heads mounted on saddles which slide on "wings." The wings, in turn, are fastened to opposite ends of a stationary floor type work-table.

Each spindle head has its own motor directly connected through gearing and is provided with power feed. The spindles are mounted in sleeves which are independently adjustable for in and out positions. Work with large and small bores is mounted

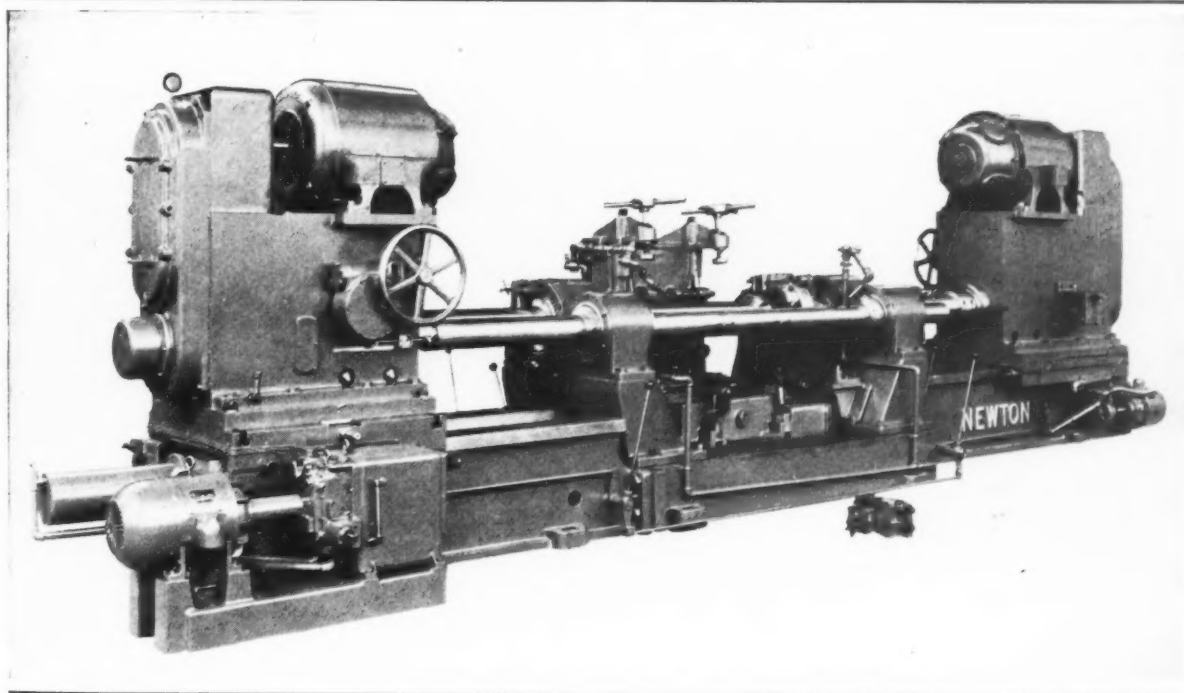
on fixtures on the work-table. The boring-bars are driven by the individual spindle heads and are piloted through bushings in the fixture.

The larger boring-bar holds a cutter-head on which are mounted sets of tools for taking roughing and semi-finishing cuts on bores of different sizes, and chamfering and facing cuts on one end of the work. This bar also has provision for holding tools for facing and boring operations on opposite ends of the work. The smaller boring-bar holds three boring tools, as well as facing tools, for performing the various operations on the smaller bores. Hydraulic feed and rapid traverse in both directions are provided for both boring-bars. Provision is made for easy, accurate adjustment and removal of all tools.

Baldor Glass-Insulated "Streamcooled" Motors

"Streamcooled" design and the use of glass as insulating material are outstanding features of a line of motors recently announced by the Baldor Electric Co., 4400 Duncan Ave., St. Louis, Mo. The woven spun glass insulating material used in these motors has the advantages of being unaffected by moisture, resistant to acids and oils, fire-proof and non-decaying.

The use of the glass insulating material and the Streamcooled design have made possible a more compact motor and one capable of withstanding much higher temperatures. For example, a standard 7 1/2-horsepower, 220-volt, three-phase, 60-cycle motor, with a speed of 1725 revolutions per minute, weighs 275 pounds, has an efficiency rating of 86 per cent and a temperature rise rating of 40 de-



Newton Two-spindle Heavy-duty Machine for Boring Cast-steel Electric Railway Motor Frames

degrees C., whereas a motor of the same size with glass insulation and Streamcooled design weighs only 183 pounds, has an efficiency rating of 88 per cent and a temperature rise rating of 75 degrees C.

The Streamcooled glass-insulated motors are available in eight sizes ranging from 1 1/2 to 20 horsepower in three-phase, 220- or 440-volt, 60-cycle, four-pole type, with a speed of 1725 revolutions per minute. 63

Ex-Cell-O Single-Spindle Boring Machine

Eighteen push-rod holes in the aluminum-alloy valve-gear case of a 9-cylinder radial aircraft engine are bored in one set-up with a specially equipped single-spindle precision boring machine built by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. The fixture on which the work is clamped is indexed by hand. A spring-loaded plunger is provided for accurate indexing, the plunger snapping into locating holes when the correct positions are reached.

A hydraulic cylinder is provided for raising and lowering the upper half of the fixture. Half of the push-rod holes are located at one height and half at another height. Eighteen buttons are provided on the lower half of the fixture for locating the work at the correct heights for drilling each push-rod hole.

The indexing table is locked

by the hydraulic cylinder during the boring operation. Production, involving ninety-nine individual boring operations, is at the rate of 5 1/2 cases per hour. The feed in this finish-boring operation is only 0.0015 inch. Between 0.008 and 0.010 inch of stock is removed for a length of 1 1/2 inches. 64

Compound Wheel-Truing Attachment

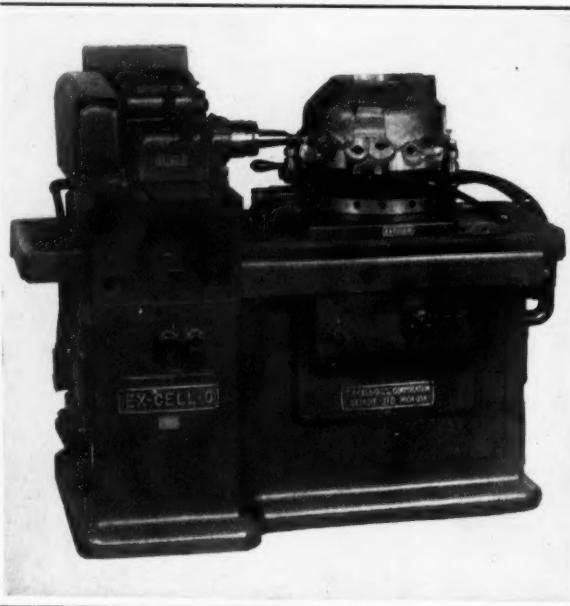
A compound wheel-truing attachment, which can be permanently mounted on the grinder spindle column for dressing the grinding wheel to any desired form, has been placed on the market by the U. S. Tool Company, Inc., Ampere, East Orange, N. J. Radial and angular contours can be ground to give a continuous formed surface. The

three adjustable slides on this unit permit truing any shape. The application of this attachment is limited only by the ingenuity of the operator. Since all of the adjustments are furnished with scales, the settings used in obtaining any form may be recorded so that the form can be duplicated at a future time.

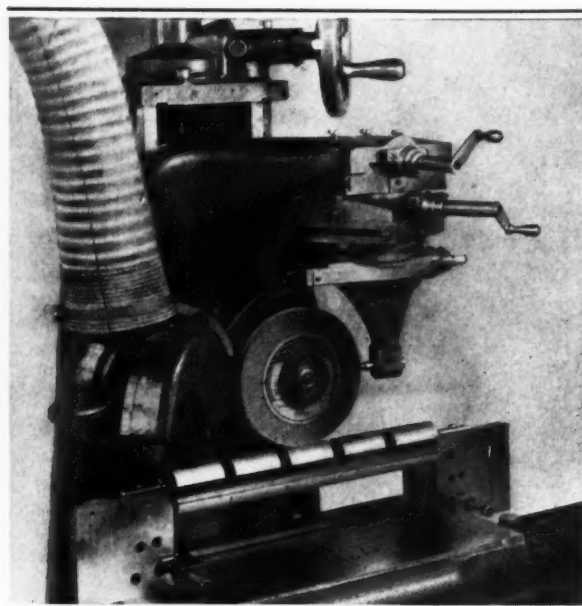
Another important feature of this truing attachment is the simplicity with which the diamond can be positioned by means of a gage. The truing diamond can be brought into position for truing the wheel without disturbing the work on the grinder table. When not in use the attachment is entirely out of the way and does not interfere with the normal operation of the machine. 65

Van Dorn Two-Speed Electric Sander

A two-speed sanding unit for use with both 7- and 9-inch abrasive disks has recently been announced by the Van Dorn Electric Tool Co., Towson, Md. As most of the wear on a sanding disk occurs near the outer edge, it is possible, with this new machine, to get the maximum wear

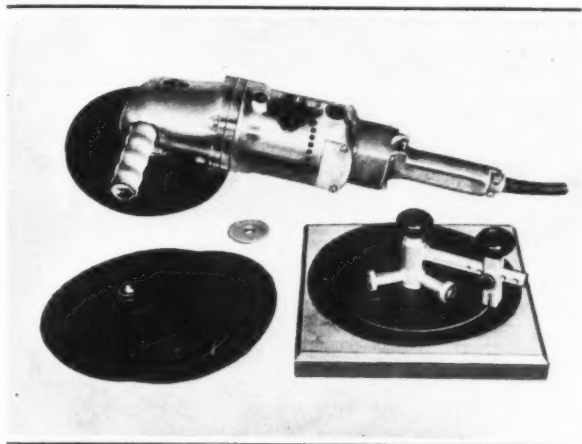


Ex-Cell-O Boring Machine which Finishes 18 Holes in One Set-up

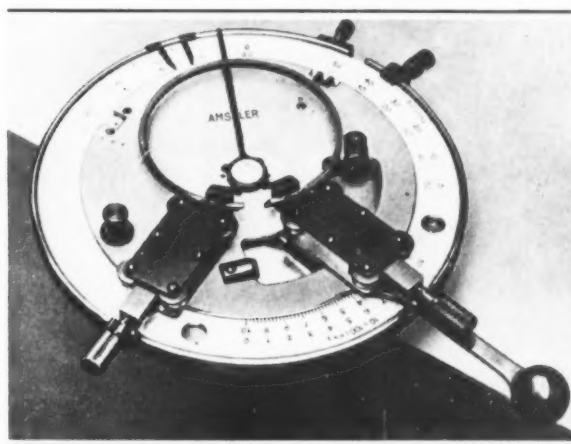


Wheel-truing Attachment for Grinding Machine Brought out by the U. S. Tool Company

SHOP EQUIPMENT SECTION



Van Dorn Electric Sander Designed to Use Disks of Two Sizes



Amsler Piston-ring Tester Placed on the Market by Herman A. Holz

from a 9-inch disk by trimming off the worn outer surface, thus reducing the disk to 7 inches. This reduction in diameter is easily accomplished by means of the disk cutter furnished with each machine.

The speed adjustment for the two sizes of disks is made by means of a simple gear-shift arrangement in the gear housing, which alternately engages two sets of double gears. The armature and intermediate gears are of the spiral type and the spindle gear is of the spiral-bevel type. The unit is equipped with a patented gear-locking pin to facilitate the interchange of flexible pads and the adjustment of the gear-shifting device. The no-load speed for the 7-inch disk is 4200 revolutions per minute and for the 9-inch disk, 2700 revolutions per minute. The universal motor operates on alternating or direct current. 66

Amsler Piston-Ring Tester

A new type of piston-ring testing device for measuring the force required to close or open the ring under test, has been developed recently by Alfred J. Amsler & Co., Schaffhouse, Switzerland, and is being introduced in this country by Herman A. Holz, 167 E. 33rd St., New York City.

The piston-ring to be tested is

placed on top of the dial, the ends being locked in two vises as shown in the accompanying illustration. The piston-ring is then closed or opened under a constant bending moment distributed over the entire circumference of the ring. A simple mathematical formula is employed to determine the relation between the bending moment, as shown by the testing device, and the lateral pressure which will be exerted against the cylinder wall by the piston-ring when it is under working conditions. Limit gages are then set above and below the scale reading which corresponds to the exact bending moment arithmetically determined. Only rings that show a bending moment within the tolerance set by the two gages pass inspection.

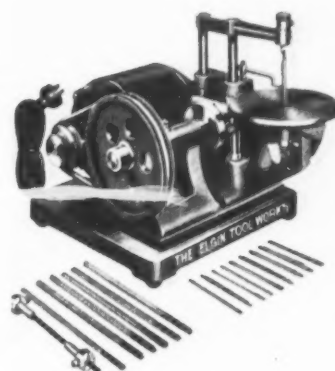
The ultimate elasticity of piston-rings is usually determined by opening them until fracture occurs, but with this testing device it is possible to make satisfactory tests on sections of piston-rings by bending their ends inward or outward. 67

Elgin Precision Motor-Driven Filing Machine

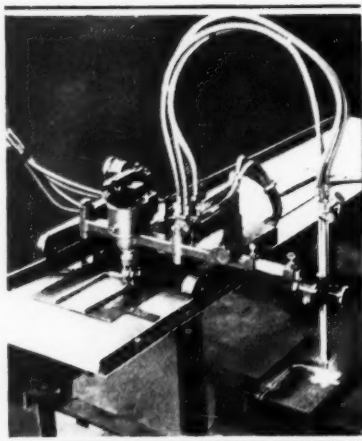
A bench type filing machine intended for use in finishing small dies, templets, models, etc., has been brought out by the Elgin Tool Works, Inc., 59 N. State St., Elgin, Ill. This machine will handle work 1 inch

thick and file up to the center of a 6-inch circle. It will hold files from the smallest size up to 5/16 inch in diameter and from 3 1/2 to 8 inches in length. The smaller files used in the machine have holes in both ends and are supported the same as a hacksaw blade in order to keep them from bending.

The holders can be turned in any direction to present the desired cutting face of the file to the work. The machine has a stroke of 2 inches and can be operated at speeds of 325 and 475 strokes per minute. The enclosed motor operates on a 110-volt, 60-cycle, single-phase circuit. The machine occupies a bench space 12 by 18 inches and weighs 75 pounds. 68



Elgin Motor-driven Bench Filing Machine



Oxy-acetylene Portable Shape-cutting Machine

Portable Oxy-Acetylene Cutting Machine

A portable shape-cutting machine is the latest addition to the line of oxy-acetylene cutting machines made by The Linde Air Products Co., 205 E. 42nd St., New York City. This machine is designed to fill a definite place in the line of cutting machines made by this company and does not displace any of the other equipment. It weighs less than 200 pounds complete. The blowpipe has a maximum lengthwise movement of 60 inches and a maximum lateral movement of 18 inches. The cutting speed can be varied from 3 1/2 to 28 inches per minute, the rate being indicated directly in inches per minute by a speedometer.

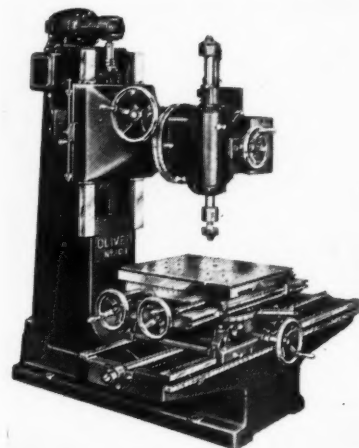
Templet tracing, hand tracing, automatic circle-cutting, and straight-line cutting can be done with this machine. Any desired shape within the range of the machine can be automatically cut by the use of templets. A straight-line cutting guide can be set for cutting to a straight line in any direction. Circles from 2 inches to 18 inches in diameter can be cut with the aid of the circle-cutting attachment. Hand tracing is accomplished by guiding the tracing wheel over a blueprint or drawing. Bevel cutting up to an angle of 45 degrees can be done in either direction by shifting the angle of the blowpipe. 69

Oliver Universal Pattern Miller

A No. 103 universal pattern miller designed to facilitate the machining of wood and aluminum patterns has recently been added to the line of pattern shop equipment built by the Oliver Machinery Co., Grand Rapids, Mich. The table is of the compound universal type, 20 by 24 inches. The main slide is 66 by 19 inches and has a travel of 54 inches.

Power raising and lowering of the head is accomplished by means of a 3/4-horsepower motor controlled by a limit switch. The head can be swiveled 45 degrees to the left and 90 degrees to the right.

The distance from the center of the spindle to the face of column is 30 inches. The maximum height from top of table to the spindle is 20 inches for the ver-



Oliver Universal Type Pattern Shop Miller

tical position and 22 inches for the horizontal position. Spindle speeds range from 1450 to 4000 revolutions per minute. 70

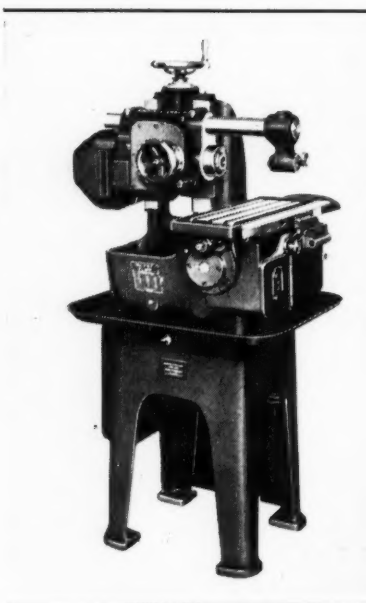
Brown & Sharpe Milling Machine for Small Work

An automatic milling cycle with exceptionally high rapid advance and return table speeds is a feature of the No. 000 plain milling machine recently an-

nounced by the Brown & Sharpe Mfg. Co., Providence, R. I. This machine has been designed specifically for rapid production milling of small pieces, such as parts for sewing machines, firearms, electrical apparatus, and business machines. Wide independent ranges of speed and feed enable it to handle efficiently a large variety of materials, using cutters down to the smallest end-mill.

The table has a longitudinal movement of 4 inches. Sixteen rates of feed ranging from 9/16 to 24 3/8 inches per minute are available.

Pressing a control button starts the automatic cycle of table movements. On completion of the cycle the table stops in the loading position. Fast traverse forward at 365 inches per minute is engaged when the table is started. The single table dog engages the cutting feed within an accuracy limit of 1/16 inch, reducing non-cutting time to the minimum. On completion of the cutting feed, fast traverse of 737 inches per minute is engaged



Brown & Sharpe Milling Machine with Rapid Traverse Feature

automatically to return the table to the loading position in one-third second. The table reversal is accurate within 0.002 inch.

The machine is furnished with either of two spindle speed ranges, namely, 160 to 3540 revolutions per minute or 107 to

2290 revolutions per minute. Sixteen speeds are available. The spindle drive is by a V-belt and cone pulleys, either direct or through reduction gearing. The swivel mounting of the spindle motor permits the V-belt to be released for changing speeds. 71

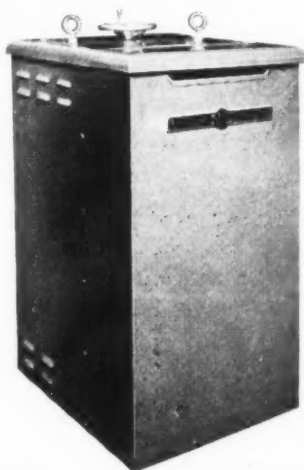
General Electric Atomic-Hydrogen Welding Equipment

Atomic-hydrogen arc-welding equipment adapted for welding special alloys and thin sections that are ordinarily difficult to weld has been announced by the General Electric Co., Schenectady, N. Y. This equipment is particularly useful where a fusion weld is required, as it produces a uniformly strong weld that is free from porosity and is smooth in appearance. Some specific applications are: The building up of broken or worn sections of molds, tools, and dies; the application of hard surfacing metal; and the welding of light-gage stainless steel. A suitable filler rod can be fed into the weld when needed.

The equipment combines in a compact portable unit all the electrical devices used with the process. Convenient terminals and pipe fittings are provided for connection to the electrode-

holder, to the power supply, and to the hydrogen source. A hand-wheel at the top of the set controls a continuously variable reactor which gives stepless current adjustment to any one of an infinite number of settings, thus permitting the use of exactly the correct current for each job. An ammeter clearly indicates the amount of current being used. The equipment and the operator are protected by the drip-proof enclosure.

For hand welding, the familiar rod type electrode-holder with suitable power and hydrogen connections is furnished, together with a supply of tungsten electrodes of the correct size. For automatic welding, equipment with a single- or multiple-arc head can be supplied, including the necessary control, means for holding the work, and traveling mechanism. The same power control unit as that employed for hand welding is applicable to automatic installations. 72



Welding Equipment Brought out by the General Electric Co.

Ex-Cell-O Production Thread Grinders and Cam Type Dresser

An improved line of production thread-grinding machines, similar in design to the precision thread grinder described and illustrated in June, 1936, *MACHINERY*, page 685, has been brought out by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich., which includes such features as: Temperature control for the coolant; new method of dressing grinding wheels, using interchangeable cams for different thread forms;



Ex-Cell-O Cam Type Dresser for Thread-grinding Wheels

greater rigidity obtained by elimination of overhanging supports; ability to grind in both traversing directions, eliminating time lost during return stroke; lead compensation for maximum accuracy regardless of room temperature; and provision for grinding tapers up to 2 inches per foot. In addition, provision is made for dressing the grinding wheel without slowing it down. Thus the wheel can be dressed under actual operating conditions.

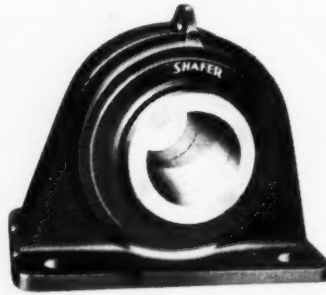
The new cam type universal dresser shown in the accompanying illustration has also been placed on the market by the same concern. With this automatic dresser, using the proper interchangeable cams, grinding wheels can be dressed to grind external threads with U. S. Standard, 60-degree sharp vee, Acme, Whitworth, and special thread forms. The unit is hydraulically power driven and is operated by a lever on the front of the machine. After each dressing the cross-feed handwheel is adjusted by micrometer graduations to compensate for the amount of the dressing cut. Provision of a lead compensator also enables the grinding of screw threads having metric pitches on a machine equipped with screws and gearing designed for grinding standard U. S. pitches.

A special internal grinding attachment is available for backing off hobs, etc. No attachment is

necessary for grinding taper threads in either direction of table travel for tapers up to 2 inches per foot. This is accomplished by swiveling the table and correcting the lead by a simple adjustment of a hand-knob on the front panel of the machine.73

Shafer "Standard Duty" Welded Pillow Blocks

The Shafer Bearing Corporation, 35 E. Wacker Drive, Chicago, Ill., has just announced a new line of "Standard Duty" roller-bearing pillow blocks. These pillow blocks are made with a new type of welded steel housing construction and are available in sizes having bores from 1 7/16 to 8 1/2 inches in diameter. The double-row roller bearing used in these pillow blocks is furnished with an extended inner race and two driving collars. The concave roller design has a large capacity for taking radial or thrust loads and combined radial-thrust loads, and allows for self-alignment. Compensation is automatically provided for misalignment or



Shafer Roller-bearing Pillow Block

shaft deflection up to 1 1/2 degrees either side of the center.

The bearing is mounted in a substantial cartridge, which, in turn, is mounted in the welded steel housing. The pillow blocks are furnished with standard duty piston-ring seals and Alemite lubrication fittings. Both fixed and expansion type pillow blocks are available. The large size pillow blocks of this line are especially adapted for use in steel mill and oil field applications. The roller-bearing pillow block shown in the accompanying illustration is a 6-inch bore unit with a four-bolt base.74



Zernickow Hand Tachometer

Zernickow Improved Hand Tachometer

A tachometer of improved design has been brought out by the O. Zernickow Co., 15 Park Row, New York City. This instrument shows at a glance, without the use of a stop watch, the following: Revolutions per minute, right or left, of revolving shafts, spindles, etc.; the surface or peripheral speeds in feet per minute, right or left, of moving members, such as flywheels, pulleys, belts, drums, planer beds, etc.; and speed variations.

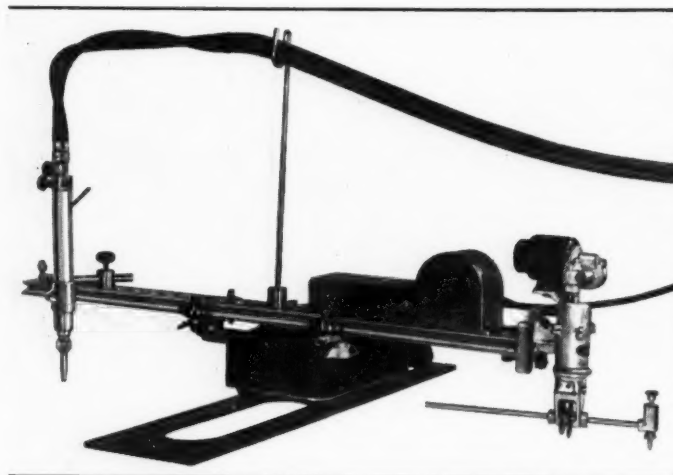
This tachometer is unaffected by magnetic fields, changes in temperature, or moisture. There are three selective range steps of 40 to 500, 400 to 5000, and 4000 to 50,000 revolutions per minute. With the standard cutmeter wheel there are three selective range steps of 12 to 150, 120 to 1500, and 1200 to 15,000 feet per minute. A push-button is provided for fixing the hand at the indicated speed, if desired, so that the reading may be taken at leisure. The readings are accurate within one-half of 1 per cent. The instrument has a dust- and moisture-proof housing and is balanced so that it can be applied as desired in any position regardless of the direction of the drive.76

Gas-O-Graph for Flame-Cutting Shapes from Plates and Billets

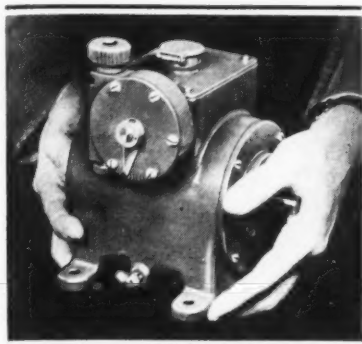
An automatic flame-cutting machine for cutting shapes of all kinds from plates and billets has been developed by Compressed Industrial Gases Inc., 221 N. La Salle St., Chicago, Ill. This machine will cut shapes up to 30 inches in width and of unlimited length. Machines for cutting wider widths can be made to order.

Cuts can be made so accurately with this equipment that machining is seldom required. The cutting can be done from a tracing, templet, or pattern and more than one torch can be used

when it is desired to take multiple cuts. The completely assembled machine weighs approximately 100 pounds.75



Gas-O-Graph for Flame-cutting Plates and Billets



Graham Variable-speed Transmission

Graham Constant-Power Variable-Speed Transmissions

Graham Transmissions, Inc., 2711 N. 13th St., Milwaukee, Wis., has recently brought out new models of the Graham speed transmissions, in which the following features have been incorporated: Positive non-slip torque responsive loading; speed range of from one-third motor speed to zero, and reverse; full torque over the entire speed range; full motor power constant over 4 to 1 speed range; speed-changing mechanism that can be set when transmission is in operation or when it is stationary; accurate maintenance of speed; and lever control, if desired, at no additional cost.

These features have been developed to increase the range of applications of this type of transmission in new fields, including machine tools, wire drawing machines, mixing machines, etc., as well as to increase their efficiency in the fields in which they are already employed.

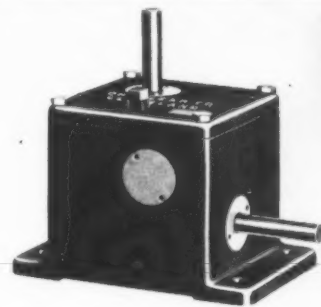
The new transmission is made in two styles, either standard or with built-in gears for stepping up or reducing the speed of the driven shaft. The speed is easily changed, either

manually or automatically. Worm control is standard, but lever control is available. The transmissions are furnished with the motor built in or coupled, as desired, in sizes from 1/6 to 15 horsepower. 77

"Ohio Gear" Speed Reducer

A small vertical double speed reducer, the outside dimensions of which are 4 1/2 by 4 1/2 by 4 1/2 inches, has been brought out by the Ohio Gear Co., 1331 E. 179th St., Cleveland, Ohio, for use where space is at a premium. The input and output shafts of this reducer, which is designated the "VOO," are located at right angles in either the horizontal or vertical plane, as desired. A variety of positions for the input and output shafts is possible.

All gears are SAE 65 (Brit-



Double Speed Reducer Made by the Ohio Gear Co.

ish gear) bronze. Either ball or Timken bearings are available. The torque capacity is 100 inch-pounds and the ratios are: 100 to 1, 200 to 1, 300 to 1, 400 to 1, and 800 to 1. With a torque capacity of 25 inch-pounds, ratios up to 1600 to 1 are available. Other ratios can also be furnished if required. 78

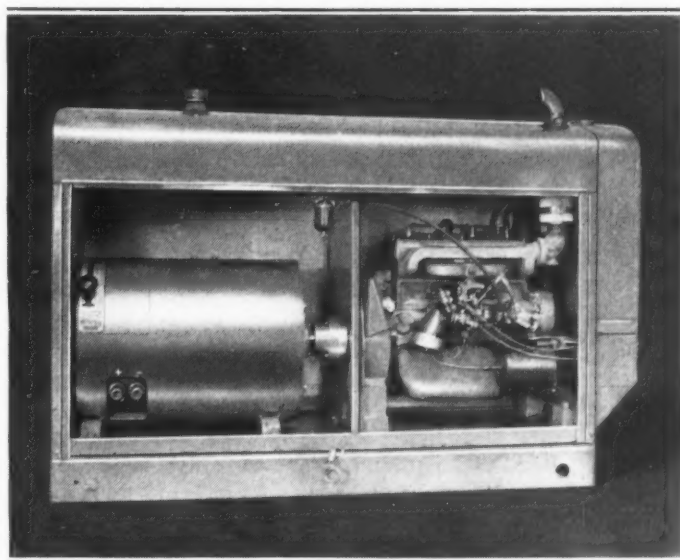
P & H-Hansen "Special" Arc Welder and "Smootharc" Electrodes

The Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis., has developed a new P & H-Hansen 200-ampere "Special" engine-driven welder to meet the demand for a welder having a wider operating range than the average 150-ampere

unit, but which will sell in a lower price range than the standard 200-ampere unit.

This welder consists of a 200-ampere, 30-volt, 6-kilowatt generator with an intermittent welding range of 35 amperes to a maximum of 225 amperes. The generator is connected by a flexible coupling to a 24-horsepower, 4-cylinder, water-cooled gasoline engine, the entire welding unit being mounted on a steel base. Electrodes up to 7/32 inch in diameter can be used under continuous manual operation.

A new "Smootharc" welding electrode, designated "Har-Ten," has also been announced by the same company. This electrode is especially designed for welding "Man-Ten," "Cor-Ten,"



P & H-Hansen 200-ampere "Special" Arc Welder

"High Steel," "Yoloy," "Republic Double Strength," and similar alloy steels now used extensively in pressure boilers.

Another "Smootharc" electrode, known as "Hartung," with a base metal of the highest quality

tungsten-molybdenum wire, has been brought out by this concern. This new electrode can be applied as a facing on regular grades of medium carbon steel to provide cutting edges equal to those of high-speed steel. 79

Eisler Vertical Type Spot-Welding Machines

A line of vertical spot-welding machines, ranging in capacity from 1 to 35 kilovolt-amperes, has been developed by the Eisler Engineering Co., 752 S. 13th St., Newark, N. J. The plunger action of the upper electrode employed on this line of welders is designed to give a high degree of accuracy in spot-welding parts used in the manufacture of typewriters, adding machines, clocks, check writers, safety razors, precision toys, etc. For welding work requiring exceptional accuracy, the machines are supplied with timers and contactors.

Either foot-, air-, or power-operated models are available and either bench or pedestal types can be supplied. The accompanying illustration shows two of the smaller sized welders. These machines are especially adapted for use where studs and lugs are to be accurately welded to sheet metal without placing or locating them in drilled holes. A standard single-phase welding

transformer provides the welding current. Six points of heat regulation are obtainable through the dial control mounted on the side of the case. 80

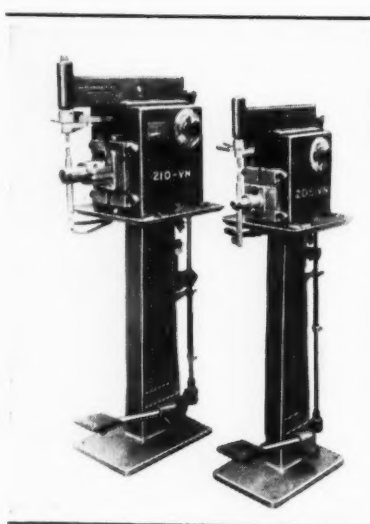


Westinghouse Timer for Welding Operations

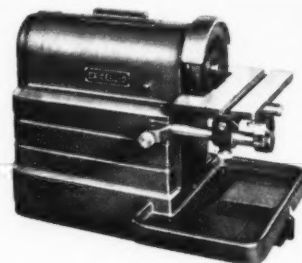
Westinghouse Ignitron Welding Timer

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has recently brought out a Type SP-11 welding timer in which improved ignitron tubes, simplified circuits, and new construction methods have been used to produce an inexpensive timer. Either of two sizes of ignitron tubes can be used in this equipment. On low-duty cycles the WL-652 tube will carry 1500 amperes at 220, 440, or 550 volts; the WL-651 tube will carry 2800 amperes at 440 and 550 volts, or 4300 amperes at 220 volts.

These new timers can be adjusted to pass currents for any exact number of cycles from 1 to 15. For longer timing periods the Type SP-11-A timer is available, which can be adjusted for from 1 to 30 cycles. 81



Eisler 10 and 5 Kilovolt-ampere Spot-welding Machines



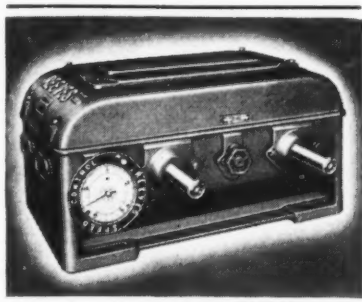
Motor-driven Grinder for Tungsten-carbide Tools

Ex-Cell-O Grinder for Tungsten-Carbide Tools

A low-cost carbide-tool grinder designed to bring the advantages of special carbide-tool grinders within the range of small shops having but a few carbide-tipped tools, has been announced by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. This grinder is a single-end, self-contained, motor-driven machine with a ball-bearing spindle, a built-in coolant reservoir, adjustable table, angle-setting dial, and protractor for use in grinding the sides, radii, and angles of round and rectangular right- and left-hand tools.

A graduated dial permits the operator to set the table accurately to any angle from 90 to 115 degrees from the wheel face. The tool-rest table, extending across and in front of the wheel face, has a slot for guiding the protractor, which is graduated in degrees. The distance from the table to the wheel is adjustable. A drum type switch controls starting, stopping, and the direction of wheel rotation. An electric motor, adjustably mounted inside the machine base, drives the grinding spindle through a V-belt. The 1/4-horsepower motor has a speed of 1725 revolutions per minute and operates on a 110-volt, 50- or 60-cycle current.

The coolant reservoir at the top of the main machine base is connected by an adjustable needle valve to an applicator which distributes a light film of coolant on the wheel. 82



Reeves Horizontal Transmission with "Speedial" Handwheel

Reeves "Speedial" Handwheel

A new type of speed indicator for Reeves variable-speed control equipment of all sizes, has been brought out by the Reeves Pulley Co., Columbus, Ind. This indicator, called a "Speedial" handwheel, is furnished as optional equipment, at extra cost, in place of the regular speed control handwheel and dial type indicator, and it may be used on units already in service.

While the standard "Speedial" is calibrated in turns of the shafting screw, space is available on the dial for the user to write in, with pen or pencil, his own calibrations in whatever corresponding units he prefers. The dial is calibrated in accordance with the transmission ratios, from 0 to 25 turns or 0 to 50 turns of the shifting screw. These calibrations appear around the circumference. The smaller scale, printed in red, represents tenths of a turn, and a small pointer printed on the transparent cover indicates these turns. Where the nature of the installation requires additional protection, the "Speedial" may be sealed water-tight. 83

"Select-O-Speed" Transmission

A variable-speed transmission, designated the "Select-O-Speed," which uses only standard V-belts and which gives an infinite selection of speeds over a 5 to 1 or larger ratio by a simple movement of a control lever, has been

brought out by the Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. This transmission is of compact flexible design and can be easily built into new equipment. It is available in several sizes up to 7 1/2 horsepower.

The variation of the speed ratio is made possible by a simple arrangement of two interlocking sheaves. These sheaves may be pivoted laterally by a slight movement of the control lever, which changes the tensions of the driving and driven belts. This change automatically adjusts the sheaves to give a new effective pitch diameter. The transmission is ball bearing



"Select-O-Speed" Variable-speed Transmission

equipped throughout. It may be mounted on the floor, wall, or ceiling and will operate without noise or vibration in any position. 84

Link-Belt Radial-Thrust Roller Bearings

The Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., has brought out a complete line of Link-Belt Shafer radial-thrust single-row and double-row roller bearings in the unmounted form. The simple and effective self-aligning action inherent in these bearings assures free rolling action with unimpaired load carrying capacity even in the presence of shaft deflection or misalignment. No provision for misalignment need be made.

Thrust capacity is provided by



Radial-thrust Roller Bearings Made by the Link-Belt Co.

the roller and raceway shapes and by the angular position of the curved rollers between curved races. There is no chance for the rollers to bind and there is no need for auxiliary means for taking the thrust. 85

Shock-Proof Portable Pyrometer

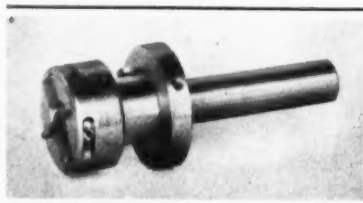
A new type shock-proof portable pyrometer has just been developed by the Illinois Testing Laboratories, Inc., 420 N. La Salle St., Chicago, Ill. The essential features of this instrument are: Spring-suspended movement designed to minimize shocks and jars; pivots and jewels especially designed for severe service; new type pointer lock for dampening the movement of the instrument when carried or transported; unusually heavy metal case designed to prevent breakage if dropped; shatter-proof glass; and a reading scale 5 inches long. 86



Portable Pyrometer Developed by Illinois Testing Laboratories, Inc.

H & G Tool Made for Threading and Tapping Simultaneously

A threading tool with which it is possible to thread and tap at the same time, even though the thread pitches are different, has been developed by the Eastern Machine Screw Corporation, 23-



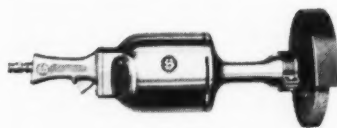
H & G Combination Threading and Tapping Tool

43 Barclay St., New Haven, Conn. This tool, when used on chucking machines, turret lathes, and automatics, enables both external and internal threads to be cut without rechucking the work. The combination tool consists essentially of an H & G solid adjustable die-head, known as Style SAM, using inserted chasers, combined with a compensating tap-holder.

The correct pressure for starting the external threading operation is provided by the tool-holder, after which the die-head floats on its own "lead," independently of the tap. By properly locating the tap in the holder, both threads can be finished simultaneously and the work reversed. The die-head part of the combination tool uses the same insert chasers employed in the regular line of inserted-chaser die-heads. 87

Portable Surface Grinder

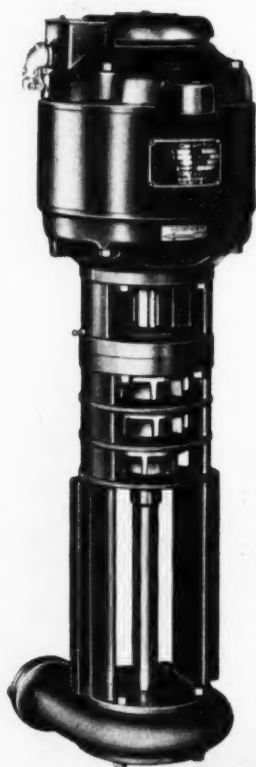
The United States Electrical Tool Co., 2488-96 W. Sixth St., Cincinnati, Ohio, has announced a new portable surface grinder built in a 6-inch, 1-horsepower size and an 8-inch, 1 1/2-horsepower size. The grinder housing is made of aluminum to secure a light-weight tool which is intended for continuous production



Portable Surface Grinder Made by United States Electrical Tool Co.

service in foundries, railroad shops, body shops, machine shops, etc., for grinding, buffing, polishing, sanding castings, and numerous other operations.

The motor operates on a 220-volt, 50- to 60-cycle, three-phase alternating current and can be used on 440 volts with a portable dry transformer. An air cleaner is provided to keep dirt and dust from entering the motor, and the ball bearings are grease packed in dustproof housings. A grip type handle is optional. 88



Ruthman Pump Designed to Handle Molten Solder

Ground Thread Gages of Cemented Carbide

The Lincoln Park Tool & Gage Co., Lincoln Park, Mich., has recently been successful in the manufacture of thread plug gages in which the threads are ground in cemented carbide. The gage shown in the accompanying illustration is used for gaging



Lincoln Park Ground Thread Gage of Cemented Carbide

the threads in a camera shutter case. The threaded portion consists of a shell of Carboloy brazed to a steel shank. This gage has 50 threads per inch and is 1 15/32 inches in diameter.

A cemented-carbide gage 1/8 inch in diameter with 44 threads per inch, is now being used for gaging in an office equipment manufacturing plant. The threaded portion of this gage is solid Carboloy butt-brazed to a standard gage shank. Thread plug gages in larger or smaller sizes than these can be produced.

While in the past, the Lincoln Park Tool & Gage Co. has done a great deal of thread grinding in solid tungsten-carbide tools, as, for example, in the manufacture of small-diameter taps, this is believed to be the first time that any concern has ground threads to gage accuracy in cemented carbide. 89

Ruthman Pump for Molten Solder or Hot Lead

The Ruthman Machinery Co., Cincinnati, Ohio, has recently developed a pump for handling molten solder or hot lead which has a specific gravity about ten times that of water and a temperature ranging from 600 to 650 degrees F.

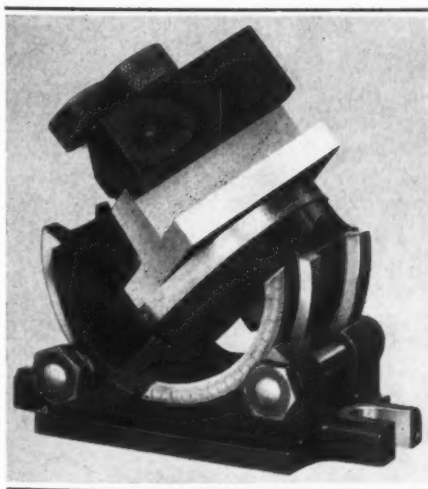
SHOP EQUIPMENT SECTION

The pump is provided with twin intakes, one above and one below the impeller, and a generous size venturi effect passage around the impeller chamber. The impeller, which is of small diameter, has blades especially designed to handle the heavy metals. The capacity at a 2-foot head is approximately 600 pounds per minute. The flow of metal can be throttled to any desired amount, without building up back pressure or overloading the driving motor.

The motor frame is provided with lifting lugs for raising the unit from the metal reservoir when not in use. The pump is lowered again into the reservoir after the solder or lead is in the molten state, when operation is resumed. 90

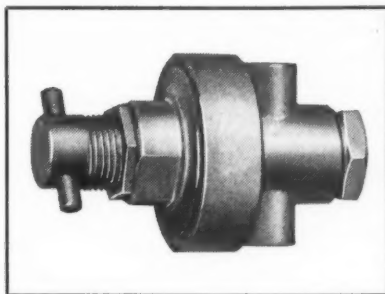
Brown Compound-Angle Vise

A compound-angle vise for use in tool and die shops as well as production plants, has been placed on the market by the Brown Tool Co., 10465 Carnegie Ave., Cleveland, Ohio. This vise is so designed that it holds work pieces at any angle or combination of angles. An independent clamping arrangement prevents distortion of the base of the vise or a change in the position of the work being clamped in it.



Compound-angle Vise Made by the Brown Tool Co.

The adaptability of this vise to complicated set-ups for grinding and other light machining operations eliminates the necessity for special fixtures. Special holding fixtures can, however, be readily used on this vise in place of the standard jaw. The maximum jaw opening is 1 1/2 inches and the width of the jaw 3 1/4 inches. The base is 3 1/2 by 8 inches. The vise weighs 14 pounds. 91



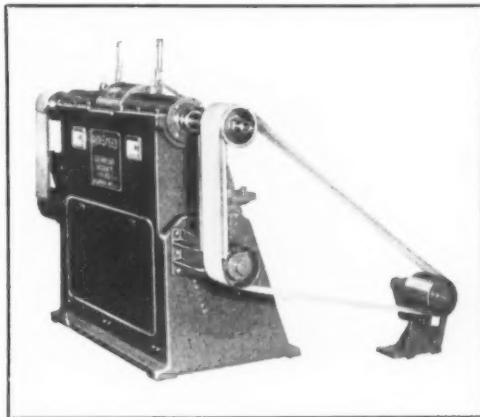
Dockson "Midget" Air Pressure Regulator

Dockson "Midget" Air Pressure Regulator

The C. H. Dockson Co., 2885 E. Grand Blvd., Detroit, Mich., has recently brought out a "Midget" regulator designed to reduce and stabilize air pressures in systems serving pneumatic devices. It can be used to reduce the air pressure from factory air lines to the pressure required for the operation of air guns, pneumatic chucks, etc. 92

Hammond Polishing Lathe and Belt Sander

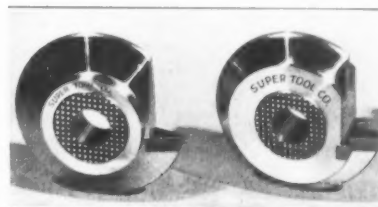
Hammond Machinery Builders, Inc., Kalamazoo, Mich., have announced a new "Rite-Speed" double-spindle combination polishing lathe and belt sander that has two separate spin-



Combination Polishing Lathe and Belt Sander Made by Hammond Machinery Builders, Inc.

dles, as shown in the accompanying illustration. Each spindle is independent of the other and is operated by its own motor, starter, multi V-belts, switch, and brake.

Either end of this machine can be used for polishing, buffing, or sanding. In order to convert this lathe from a sander to a polisher, it is only necessary to remove the drive pulley mounted on the spindle and replace it with a polishing wheel. 93



Carbide Tipped Forming Tools Made by the Super Tool Co.

Carbide Tipped Circular Forming Tools

Circular forming tools with cemented tungsten-carbide tips such as shown in the accompanying illustration, which have all the advantages of carbide tipped straight cutting tools, have been brought out by the Super Tool Co., 356 E. Congress St., Detroit, Mich. These circular forming tools have been developed to give longer service between grinds, permit higher speeds, and eliminate idle machine time. 94

NEWS OF THE INDUSTRY

California and Washington

UNION HARDWARE & METAL Co., Los Angeles, Calif., has been appointed distributor of Enduro stainless steel for the Republic Steel Corporation, Cleveland, Ohio.

N. A. STRAND & Co., Chicago, Ill., manufacturers of flexible shafts, machines and attachments, have appointed the CAMPBELL HARDWARE & SUPPLY Co., Seattle, Wash., exclusive distributors for the State of Washington.

Illinois, Missouri, and Wisconsin

ALLIED SCREW MACHINE Co., INC., 609 W. Lake St., Chicago, Ill., has announced that the three winners in the company's \$400 trade school scholarships at the Allied School are STANLEY B. BUCK, Cicero, Ill., who will take courses in automatic screw machine work, tool- and die-making and designing and drafting; GEORGE COBB, Chicago, Ill., who will take a course in automatic screw machine work; and GEORGE SONNEKER, Chicago, Ill., who will take a course in tool- and die-making.

H. B. SPACKMAN has been appointed vice-president in charge of sales and advertising of Lyon Metal Products, Inc., Aurora, Ill. Mr. Spackman was formerly with the U. S. Gypsum Co. in its steel products division.



H. B. Spackman, Vice-president
of Lyon Metal Products, Inc.,
Aurora, Ill.



A. L. Petersen, Newly Appointed
Manager of the St. Louis Plant,
Joseph T. Ryerson & Son, Inc.

A. L. PETERSEN has been appointed manager of the St. Louis plant of Joseph T. Ryerson & Son, Inc. Mr. Petersen is a graduate of the Armour Institute of Technology. He has been with the Ryerson company for twenty-five years; for some time past, he has been assistant manager of the St. Louis plant.

GENERAL TIME SERVICE, 1507 W. Vliet St., Milwaukee, Wis., has been organized to specialize in repairing and reconditioning time-recording instruments, including fabrication of parts, gears, etc.

Michigan

FORD MOTOR Co., JOHANSSON DIVISION, Dearborn, Mich., announces that a new service is being extended for reconditioning of gage-blocks of 2-, 3-, and 4-inch sizes. Previously, reconditioning service has been available only for blocks of the 5-inch size or larger. Worn blocks can in most cases be renewed, thus virtually doubling their useful life.

GENESEE TOOL Co., Fenton, Mich., announces that the company has entered into the cutting tool field. When originally established in 1934, it produced dies and stampings. Now it is prepared to furnish all types of milling cutters, forming tools, turning and facing tools, saws, reamers, boring-bars, cutter blades and tool-bits, as well as special tools.

RAYMOND SZYMANOWITZ, formerly technical director of the Acheson Colloids Corporation, Port Huron, Mich., has been made vice-president and technical director of Acheson Industries, Inc., a technical development company for the Acheson interests. In his new capacity, Mr. Szymanowitz will continue to supervise all research activities of the Acheson Colloids Corporation.

DR. C. F. HIRSHFELD, chief of research of the Detroit Edison Co. and past-chairman and member of the Engineers' Council for Professional Development, was awarded the honorary degree of Doctor of Engineering by the University of Detroit at the recent commencement exercises.

TROY TOOL & DIE Co., 5736 Twelfth St., Detroit, Mich., has appointed CHARLES G. EATON sales representative for the company in the mid-west territory.

New England

EDWIN L. LARSON has been appointed assistant sales manager of the machine tool division of the Van Norman Machine Tool Co., Springfield, Mass. Mr. Larson was formerly chief engineer of the Bausch Machine Tool Co., but for the last two and one-half years he has been connected with the Van Norman company in its engineering department.

R. E. TAYLOR has been appointed sales research manager of the Norton Co., Worcester, Mass., succeeding Milton P. Higgins, who was recently made resident manager of the Norton Co.'s electric furnace plant of Chippawa, Ontario. Mr. Taylor has been connected with the Norton Co. for seventeen years.

F. W. MCINTYRE, vice-president and general manager of the Reed-Prentice Corporation, Worcester, Mass., sailed on the *Queen Mary*, July 6, for an extended trip to England and France. He plans to return early in September.

BILLINGS & SPENCER Co., Hartford, Conn., announces that the company has acquired the Windsor Automatic Co., Inc., Windsor, Vt. This business will be moved to Hartford and will be operated as a division of Billings & Spencer Co. The principal product of the Windsor Automatic Co. is a Di-matic automatic screw machine which was illustrated and described in *MACHINERY*, March, 1936, page 477.

New York and New Jersey

OAKITE PRODUCTS, INC., 22 Thames St., New York City, manufacturers of industrial cleaning and plant maintenance materials, announce the recent transfer of A. C. DALY, sales and service representative formerly covering the Wil-

mington, Del., district, to the company's Hartford, Conn., territory. J. J. MAGUIRE, who has been with the company headquarters for the past several years, will take over Mr. Daly's former territory, operating from 1701 Arch St., Philadelphia, Pa.

E. O. SHREVE, vice-president of the General Electric Co. in charge of sales, has been awarded the Marston medal of the Iowa State College for outstanding achievements in the engineering field. Mr. Shreve has been connected with the General Electric Co. since 1904 and has held his present position since 1934.

HILL CLUTCH MACHINE & FOUNDRY Co., formerly located at 42 Main St., Orange, N. J., has established a New York office at 90 West St. This office will operate as the eastern branch for power transmission and agitator sales. A. L. WHITESIDE, eastern representative for the company, will be in charge.

FRANK O. PARKER, sales manager of the Acme Steel & Malleable Iron Works, Buffalo, N. Y., was elected president of the Malleable Founders' Society at the Society's recent annual meeting at White Sulphur Springs, W. Va.

ALEXANDER G. CHRISTIE, Professor of Mechanical Engineering, Johns Hopkins University, Baltimore, Md., has been nominated for president of the American Society of Mechanical Engineers.

PERCY M. BROTHERHOOD & SON, machine tool dealers and agents, have moved their offices from 114 Liberty St., to the South Ferry Building, 44 Whitehall St., New York City.

HARRY E. MILLER, consulting manufacturing engineer and former manager of the Newark meter works of the West-

inghouse Electric & Mfg. Co., retired June 30 after having occupied executive positions at the Newark works for the last thirty-eight years. In all, he had completed forty-nine years of service with the Westinghouse company when he retired.

THE WATSON-STILLMAN Co., Roselle, N. J., announces that a contract has been made with Duncan Stewart & Co., Ltd., of Glasgow, covering the manufacture for the British market of the Watson-Stillman lines of hydraulic horizontal extrusion presses, high-speed metal-forming presses, powder presses, ingot strippers, and other equipment used by the heavy industries. In turn, The Watson-Stillman Co. will manufacture for the American market the Duncan Stewart lines of high-speed steam hydraulic forging presses, vertical rod and tube extrusion presses, air bottle accumulators, and similar equipment.

Ohio

PHILIP O. GEIER, chairman of the board and treasurer of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has been elected president of the Ohio Manufacturers' Association to succeed the late Charles F. Michael of Bucyrus, Ohio. Mr. Geier, who has been a trustee of the Ohio Manufacturers' Association for almost twenty years, expects that the activities of the Association will be constantly expanded to cope with the many new problems confronting manufacturing enterprises. Mr. Geier is identified with numerous civic and business activities in Cincinnati. He is a trustee of the Cincinnati Southern Railroad and was formerly president of the Cincinnati Chamber of Commerce.

THOMAS WEISKOPF, formerly assistant superintendent of the Union Drawn Steel Division plant of the Republic Steel Corporation, at Massillon, Ohio, has been appointed superintendent of the plant. FRANK A. GARVEY has been appointed assistant superintendent. Mr. Weiskopf has been with the Union Drawn Steel Division for thirty-five years. Mr. Garvey has been in the automotive and machine tool industries for fifteen years. For the last eighteen months, he has been with the Union Drawn Steel Division.

MONARCH MACHINE TOOL Co., Sidney, Ohio, has developed a colored motion picture film showing the procedure by which Monarch lathe beds are flame-hardened. Standard lantern slides are also available which show this process. The film or the slides will be loaned, without obligation, to technical societies, industrial groups, and other interested organizations.

Pennsylvania

WILLIAM J. DALY, formerly Detroit district sales manager for the Worthington Pump & Machinery Corporation, Harrison, N. J., has been transferred to the company's Philadelphia office, succeeding the late C. H. Shaw. Mr. Daly, a graduate of Notre Dame University, has been with the Worthington organization since 1922 in the engineering and sales divisions. He will be assisted by W. J. VAN VLECK, recently appointed assistant manager in the Philadelphia district.

GEORGE P. PASSMORE has been appointed manager of manufacturing of the steam division of the South Philadel-



Harry E. Miller, Who has Retired from the Newark Meter Works of Westinghouse Elec. & Mfg. Co.



Philip O. Geier, Newly Elected President of the Ohio Manufacturers' Association



George P. Passmore, New Manager of Manufacturing, Westinghouse South Philadelphia Plant

*for Faster Milling
of Small Pieces...*

N^o 0000

... a New Plain Milling Machine

**Extremely Rapid Automatic Milling Cycle —
advance, 365" per min.— return, 737" per min.**

Unusually Small Floor Space - 33⁵/₈" x 39⁷/₈"

**Learn more about its profit-
producing features. Ask for details.**



Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

BROWN &



SHARPE

phia Works of the Westinghouse Electric & Mfg. Co. Mr. Passmore, who is a graduate of the Drexel Institute, has been with the Westinghouse organization since 1921, having served as machinist, shop foreman, tool designer, layout draftsman, superintendent of tool design, and superintendent of heavy manufacturing.

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa., announces the completion of a modern wire rope plant at Muncy, Lycoming Co., Pa. The new plant will be known as the Gilmore Wire Rope Division of the Jones & Laughlin Steel Corporation. The fabrication and sale of the products of the new plant will be under the direction of ROBERT GILMORE, general manager.

CHARLES V. ALLEN, treasurer of the Westinghouse International Co., since 1925, has retired after forty-five years of continued service with the Westinghouse Electric & Mfg. Co. Mr. Allen graduated from the Massachusetts Institute of Technology in 1893, and immediately joined the Westinghouse organization.

M. K. MELLOTT & Co., Grant Bldg., Pittsburgh, Pa., has been formed to take over the business of Mellott & Snyder, all interests in which have been acquired by M. K. MELLOTT. The new company will continue to serve clients without change or interruption.

WILLIAM C. SIMPSON has been appointed manager of sales for the newly opened sales office in the Gulf Building, Pittsburgh, Pa., of the Lukens Steel Co., Coatesville, Pa. Mr. Simpson graduated from the Lehigh University in 1932. He joined the Bethlehem Steel Co., Sparrows Point, Md., in 1933, and came with the Lukens organization in 1934.



William C. Simpson, Manager of Sales, Pittsburgh Office of the Lukens Steel Co.



Newbold C. Goin, Sales Manager, Gearing Division, Nuttall Works, Westinghouse Elec. & Mfg. Co.

NEWBOLD C. GOIN has been appointed sales manager of the gearing division of the Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa., succeeding L. R. BOTSAL, who has become sales manager of the company's small motor division at Lima, Ohio. Mr. Goin has been with the Westinghouse company since 1917.

R. L. SACKETT, dean of the School of Engineering of the Pennsylvania State College from 1915 to 1937, has been awarded the Lamme medal for achievements in the engineering educational field, by the Society for the Promotion of Engineering Education.

COMING EVENTS

AUGUST 31-SEPTEMBER 3—Twenty-first annual CONFERENCE ON INDUSTRIAL RELATIONS at Silver Bay, Lake George, N. Y. E. H. T. Foster, executive secretary, 347 Madison Ave., New York City.

SEPTEMBER 19-23—SEVENTH INTERNATIONAL MANAGEMENT CONGRESS at Washington, D. C. Executive secretary, Nathaniel W. Barnes, Room 1201, 347 Madison Ave., New York City.

SEPTEMBER 21-23—Sixteenth annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at the Hotel Statler, Cleveland, Ohio. Stanley Knisely, general conference chairman, Republic Steel Corporation, Cleveland, Ohio; Ralph Leavenworth, program committee chairman, Fuller & Smith & Ross, Inc., Cleveland, Ohio.

OCTOBER 5-7—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Hotel Biltmore, Providence, R. I. C. E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 10-12—Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Skytop Lodge, Cresco, Pa., J. C. McQuiston, manager-secretary, 701-2 Shields Building, Wilkinsburg, Pa.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 13-15—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Ambassador Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 14-16—FOREMEN'S EXPOSITION to be held in Goodyear Hall, Akron, Ohio, under the auspices of the National Association of Foremen, and in conjunction with the fifteenth annual convention of the Association. For further information address Clapp & Pollak, Inc., 232 Madison Ave., New York City.

OCTOBER 16-21—Annual meeting of the AMERICAN WELDING SOCIETY at Book-Cadillac Hotel, Detroit, Mich.

OCTOBER 17-21—NATIONAL METAL CONGRESS AND EXHIBITION, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. Further information can be obtained by communicating with W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 27-29—First regional conference of the Chicago Chapter of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Purdue University, Lafayette, Ind. For further information address Professor William Knapp, Assistant Dean of Engineering, Purdue University, Lafayette, Ind.

NOVEMBER 11-19—NATIONAL AUTOMOBILE SHOW at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

NOVEMBER 14-16—National Transportation Engineering Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Commodore Hotel, New York City. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

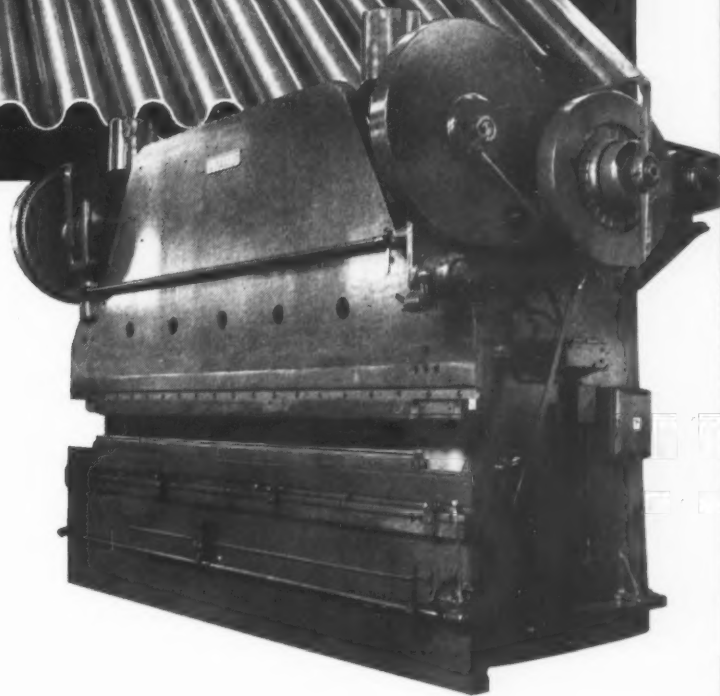
DECEMBER 5-9—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Engineering Societies Building, 29 W. 39th St., New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

JANUARY 9-13, 1939—Annual Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.



16' sheets for modern transport planes, formed on a 340 Series Cincinnati All-Steel Press Brake.

FOR the Wings of Man
... aluminum alloy sheets
must be accurately corru-
gated... a job typical of the
machine tool accuracy of
Cincinnati Press Brakes...



THE CINCINNATI SHAPER COMPANY
CINCINNATI, OHIO

OBITUARIES

Russell B. Hurlburt

Russell B. Hurlburt, foreign sales manager for Pratt & Whitney, Division Niles-Bement-Pond Co., died July 17 at his home in New Rochelle, N. Y. He was born in Epsworth, Iowa, in 1887 and was graduated from Cornell University in 1910. Mr. Hurlburt was associated with the Niles-Bement-Pond Co. for twenty-four years and held many responsible positions. From 1929 to 1936, he was in Europe in connection with foreign sales in Paris, London, and Brussels. For the past year, he has been in New York, acting as foreign sales manager for the company. In commenting upon his death, Clayton R. Burt, president of the Niles-Bement-Pond Co., praised his energy and ability and said: "There are hundreds of friends of Russell B. Hurlburt here and throughout Europe who will mourn his passing."

George E. Emmons

George E. Emmons, formerly manager of the Schenectady Works of the General Electric Co., and later vice-president in charge of manufacturing of the company, died in Pasadena, Calif., July 1 at the age of eighty years. Mr. Emmons was born in 1857. He was one of those early leaders in the electrical industry whose training began in the factory rather than in the engineering school. After having worked for some years in a country store, he obtained employment in 1886 with the Thomson-Houston

Electric Co., of Lynn, Mass., which in 1892 was merged with the Edison-General Electric Co., to form the present General Electric Co. From 1886 until his retirement in 1924, he was continuously employed by these companies. In 1893 he was appointed manager of the Lynn Works of the General Electric Co., and in 1894 he was transferred to Schenectady as assistant manager of the Schenectady Works. A year later he was appointed manager, a position which he held for twenty-five years. In 1916 he also became vice-president in charge of manufacturing, which position he held until his retirement. During his administration the Schenectady plant attained its present immense proportions. He was also instrumental in the development of the company's plants in other localities.

NEW BOOKS

HOW TO RUN A LATHE. 128 pages, 350 illustrations. Published by the South Bend Lathe Works, South Bend, Ind. Price, 25 cents (stamps or coin of any country are accepted).

This is the thirty-fourth edition of a well-known machinist's manual that was first published by the South Bend Lathe Works in 1907 in the form of a 16-page booklet. Of this and subsequent enlarged editions more than 1,500,000 copies have been distributed. The thirty-fourth edition, which has been completely revised, besides dealing with all phases of lathe work, also includes a great deal of shop

information, reference tables, and formulas. In addition to being printed in English, this book is also available in French, Spanish, Portuguese, Swedish, and Dutch.

ARTIFICIAL LIGHT AND ITS APPLICATIONS. 258 pages, 8 1/2 by 11 inches. Published by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Price, 75 cents.

This is a new edition of a lighting handbook covering all phases of lighting in industry, commerce, and the home. The new edition has been thoroughly revised to include the rapid advances made in the science of lighting during the last two years. The book contains twelve chapters more than the previous edition, some of which are new and others elaboration of the previous material. The new material includes chapters on photometry, color, theater lighting, and sports and recreational lighting.

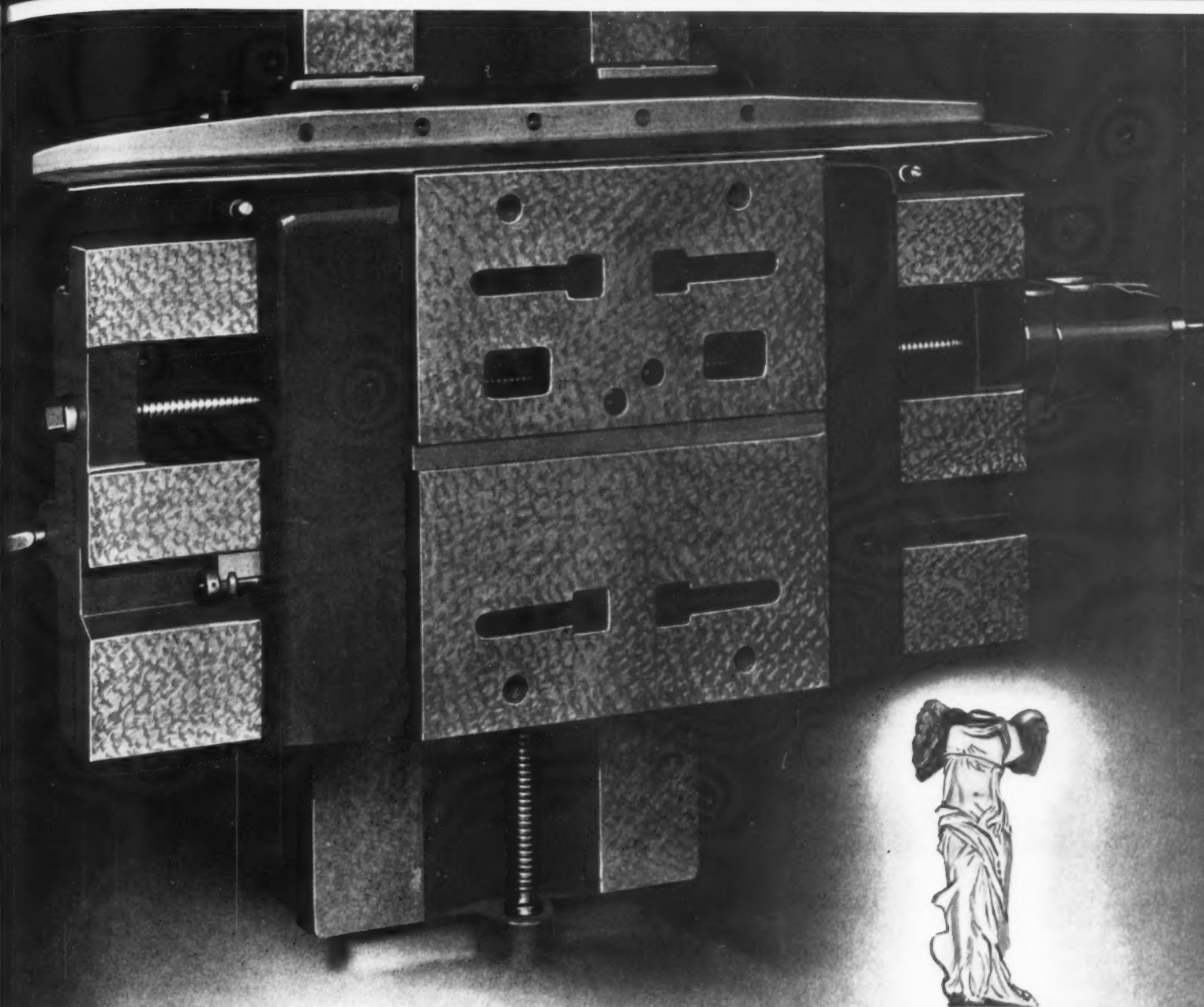
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Belgian Machinery Dealer Moves Into New Quarters

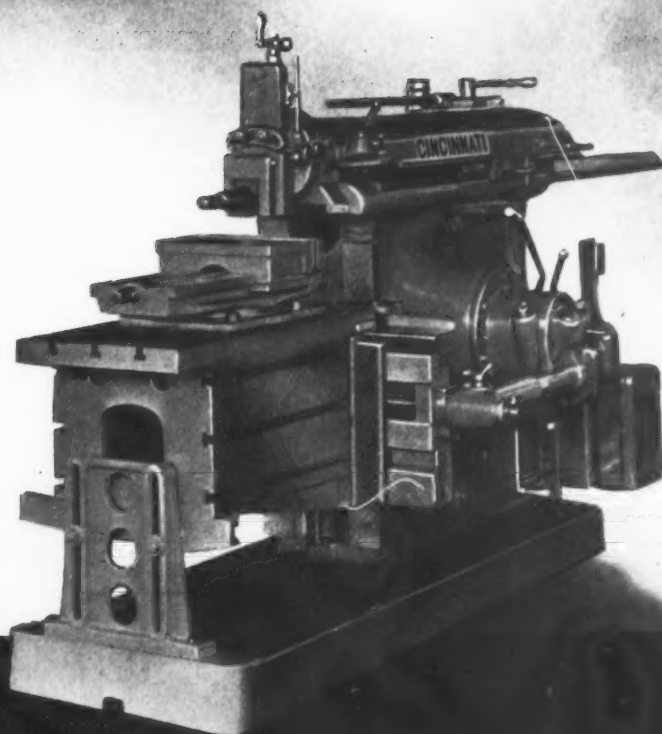
The firm of Henri Benedictus of Brussels, Belgium, has moved into new quarters at 34-36, rue Melsens, Brussels. The building was especially built for the purpose for which it will be used. Among American machine tool builders, Henri Benedictus represents the Norton Co., Pratt & Whitney Co., R. K. LeBlond Machine Tool Co., Sundstrand Machine Tool Co., American Broach & Machine Co., Cone Automatic Machine Co., Fellows Gear Shaper Co., Heald Machine Co., Westcott Chuck Co., and numerous other manufacturers.



Recently the Harnischfeger Corporation, Milwaukee, Wis., completed the Ten-thousandth Crane Built by the Organization. These Ten Thousand Cranes Represent Over \$100,000,000 Worth of Lifting, Lowering, and Moving Equipment. The Illustration Shows Ben Van Horn, Sales Manager of the Crane Division of the Corporation, Affixing the Nameplate to the Just Completed 40-ton, 100-foot Span Crane, which Bears the Inscription "No. 10,000."



The new wide apron bearing and husky rail . . . bring accurate, smooth cutting on Cincinnati Shapers.



THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS • SHEARS • BRAKES

OBITUARIES

Jordan Korp

Jordan Korp, of the Leeds & Northrup Co., died of a heart attack at his home in Philadelphia on August 10. Mr. Korp was widely known wherever the art of heat-treating was practiced or



discussed. He was born in Christiania (Oslo), Norway, in 1873. His father, a Norwegian blacksmith of progressive tendencies, interested in the improvement of his art, was instrumental in the development of what was then an ultra-modern machine for the manufacture of horseshoe nails. With this early association, it is not surprising that, in 1904, Mr. Korp, in competition with other young men throughout Norway, was selected by the Norwegian government as one of those to come to the United States for a post-graduate course in his trade as toolmaker, and to secure the most modern ideas for the further development of the tool and machine industry in Norway.

After almost a year in this country, he returned to Norway and made his report. He then came back to the United States, and as soon as it was possible for him to do so, he became a citizen. He obtained a position as toolmaker with the Leeds & Northrup Co., soon becoming foreman of the toolroom. Actively interested in the development of improved methods of hardening, he contributed much to the now well-known Hump Method.

GEORGE ROBERT BOTT, chief engineer and a director of the Norma-Hoffmann Bearings Corporation, Stamford, Conn., died of heart failure on August 14, at his summer home in New Canaan, Conn. He was fifty-eight years old, and had been a resident of Stamford for about thirteen years.

Mr. Bott was born in Columbus, Ohio, March 20, 1879. He was graduated from Ohio State University in the class of 1901, and later became a member of the faculty. Twenty-five years ago, he joined the Norma-Hoffmann organization.

One of the pioneers in the bearing industry, Mr. Bott held numerous patents on anti-friction bearings and other mechanical devices. He was a member of the Society of Automotive Engineers and of the American Society of Mechanical Engineers.

G. ADOLPH SCHREIBER, consulting engineer, Detroit, Mich., died Monday, August 16, from injuries received in an automobile accident on July 21. He was fifty-six years old. Mr. Schreiber was born in Germany, and early in his professional career had charge of tool design and shop equipment for the Daimler Motor Works. Nearly thirty years ago he came to the United States, locating in Detroit, where he was employed first by the E.M.F. Co. and then by the Paige Motor Car Co. When Mr. Chrysler organized the Willys-Overland Works, Mr. Schreiber was one of his production engineers. Later he was connected with the White Motor Co. and the General Motors Truck Corporation. Some years ago, he established himself as consulting engineer in the automotive industry.

GEORGE W. FOWLER, Chicago office manager of the New Departure Division of General Motors Corporation, Bristol, Conn., died on August 9, following an extended illness. Mr. Fowler, who would have completed twenty years with New Departure next December, founded its sales and engineering office at Chicago. The company's successful operation in the mid and far West is largely due to his character and ability.

He was born in New York City, September 22, 1876, and went to work after two years of high school. Among his previous business connections were Garwood Electric Co., Crocker-Wheeler Co., and the Schafer Ball Bearing Co. He was loved and will be missed by customers and associates alike.

C. C. McCONVILLE, superintendent of the Clintonville, Wis., plant of the Four Wheel Drive Auto Co., died suddenly August 10 of a heart attack while in the factory. He had been in apparently good health. Mr. McConville was a graduate of the University of Wisconsin, class of 1898. In 1900, he became superintendent of the plant of the Emerson Brandt Co. Later he was superintendent of the Big Four Tractor Co., Minneapolis, Minn. In 1916, he became superintendent of the Four Wheel Drive Auto Co. He was a member of the Society of Automotive Engineers.

ADELBERT G. CLARK, for twenty-seven years purchasing agent for the Shepard Niles Crane & Hoist Corporation, Montour Falls, N. Y., died on August 6, after a brief illness.

COMING EVENTS

SEPTEMBER 20-22—Twentieth semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Spink-Wawasee Hotel, Lake Wawasee, Ind. J. C. McQuiston, manager-secretary, Penn Lincoln Hotel, Wilkesburg, Pa.

SEPTEMBER 23-25—Conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at Edgewater Beach Hotel, Chicago, Ill. For further information address National Industrial Advertisers Association, Inc., 100 E. Ohio St., Chicago, Ill.

OCTOBER 4-6—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Lawrence, Erie, Pa. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 4-9—POWER AND MECHANICAL ENGINEERING EXPOSITION at the International Amphitheater, Chicago, Ill. Further information can be obtained from the Executive Offices of the Exposition, Grand Central Palace, New York City.

OCTOBER 18-22—NATIONAL METAL CONGRESS AND EXPOSITION to be held in the Atlantic City Auditorium, Atlantic City, N. J., under the auspices of the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 18-22—Eighteenth annual meeting and exposition of the AMERICAN WELDING SOCIETY at Atlantic City, N. J.; headquarters, Hotel Traymore. Secretary, M. M. Kelly, 33 W. 39th St., New York City.

OCTOBER 19—Meeting of the Machine Shop Practice Division of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in conjunction with the American Welding Society's annual meeting at Atlantic City, N. J. C. E. Davies, secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

OCTOBER 27-NOVEMBER 3—NATIONAL AUTOMOBILE SHOW, at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

DECEMBER 6-10—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Societies Building, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 8-10—National Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Flint, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

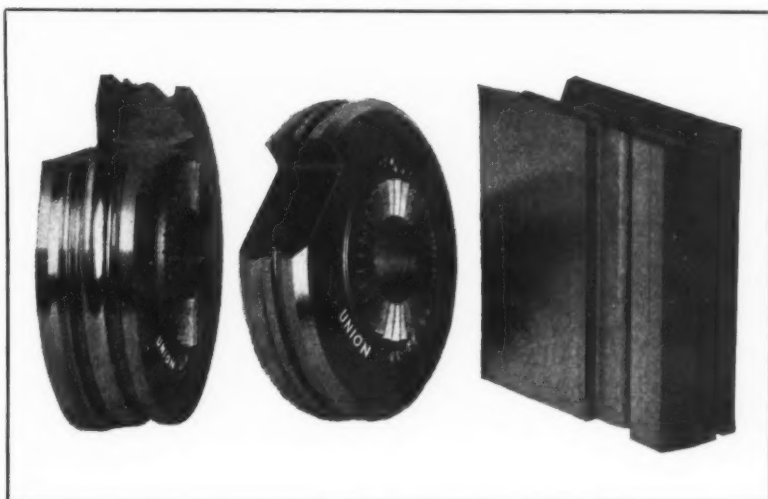
SHOP EQUIPMENT SECTION

tions per minute. Four wheels from 1 1/2 inches by 1/4 inch by 1/4 inch up to 4 inches by 1/2 inch by 1/2 inch are supplied. The motor is of 1/4 horsepower and operates on 110-volt 60-cycle alternating current only. The rotor is mounted in closed type ball bearings, and the grinding spindle is also mounted in ball bearings. The minimum distance from the mounting base to the center of the spindle is 1/4 inch. Internal and external grinding spindle extensions are available. 88

Union Circular and Flat Forming Tools

With the increased demand for circular and flat forming tools ground to particularly close limits, the Union Twist Drill Co., Athol, Mass., announces that the company is equipped to produce these tools for the trade, making them either from drawings, sample tools, or samples of work, and grinding them to the desired outline with great accuracy.

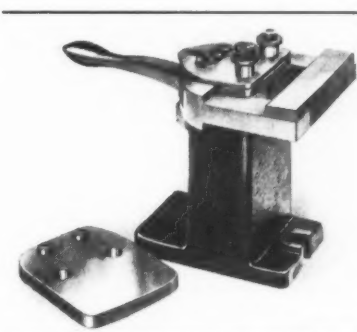
The accompanying illustrations show a few of the types of tools that the company is prepared to furnish—the circular type tools being for use in screw machines, and the straight type for use in lathes or turning machines in general. 89



Circular and Flat Forming Tools Made by the Union Twist Drill Co.

Knu Knuckle-Action Vise

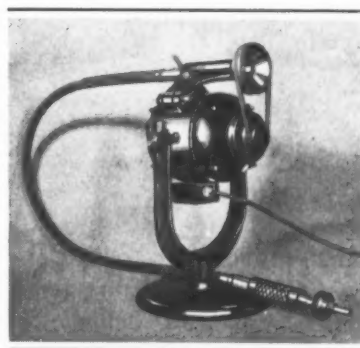
A knuckle-action vise has recently been developed by the Knu-Vise Products Co., 6432 Cass Ave., Detroit, Mich., which is intended primarily for use in production operations and is adaptable to drilling, reaming, tapping, countersinking, milling, inspecting, and other operations. The vise jaws open 3/4 inch with the movement of the handle, which is sufficient for most jobs. One blank jaw-insert is supplied



Knuckle-action Vise Made by Knu-Vise Products Co.

with each vise to be finished to suit the job for which the vise is intended.

This vise can be converted into a drill jig by the provision of a bushing plate and angle support bracket. 90



Stow Three-speed Flexible-shaft Unit

Stow Three-Speed Bench Type Flexible-Shaft Machine

Three operating speeds are available on a bench type flexible-shaft machine known as Assembly P, which is being introduced on the market by the Stow Mfg. Co., Inc., Binghamton, N. Y. In addition to bench use, this equipment can be mounted on a truck or a wall.

The equipment is provided with a ball-bearing countershaft which is hinged and provided with a belt adjustment. The motor and the countershaft unit can be swiveled in both horizontal and vertical planes, so that the flexible shaft can be used in any position.

The regular equipment includes a ball-bearing hand-piece with clamp spindle which takes grinding wheels, buffs, scratch-brushes, etc. Angle-heads and special hand-pieces that are interchangeable with the standard hand-piece can also be supplied. This flexible-shaft equipment is manufactured in seven models, ranging in capacity from 1/8 to 1 horsepower. Spindle speeds of 900, 1725, and 3400 revolutions per minute, or 1800, 3425, and 6800 revolutions per minute, are obtainable. 91

Wheelco "Proportioning Capacitrol"

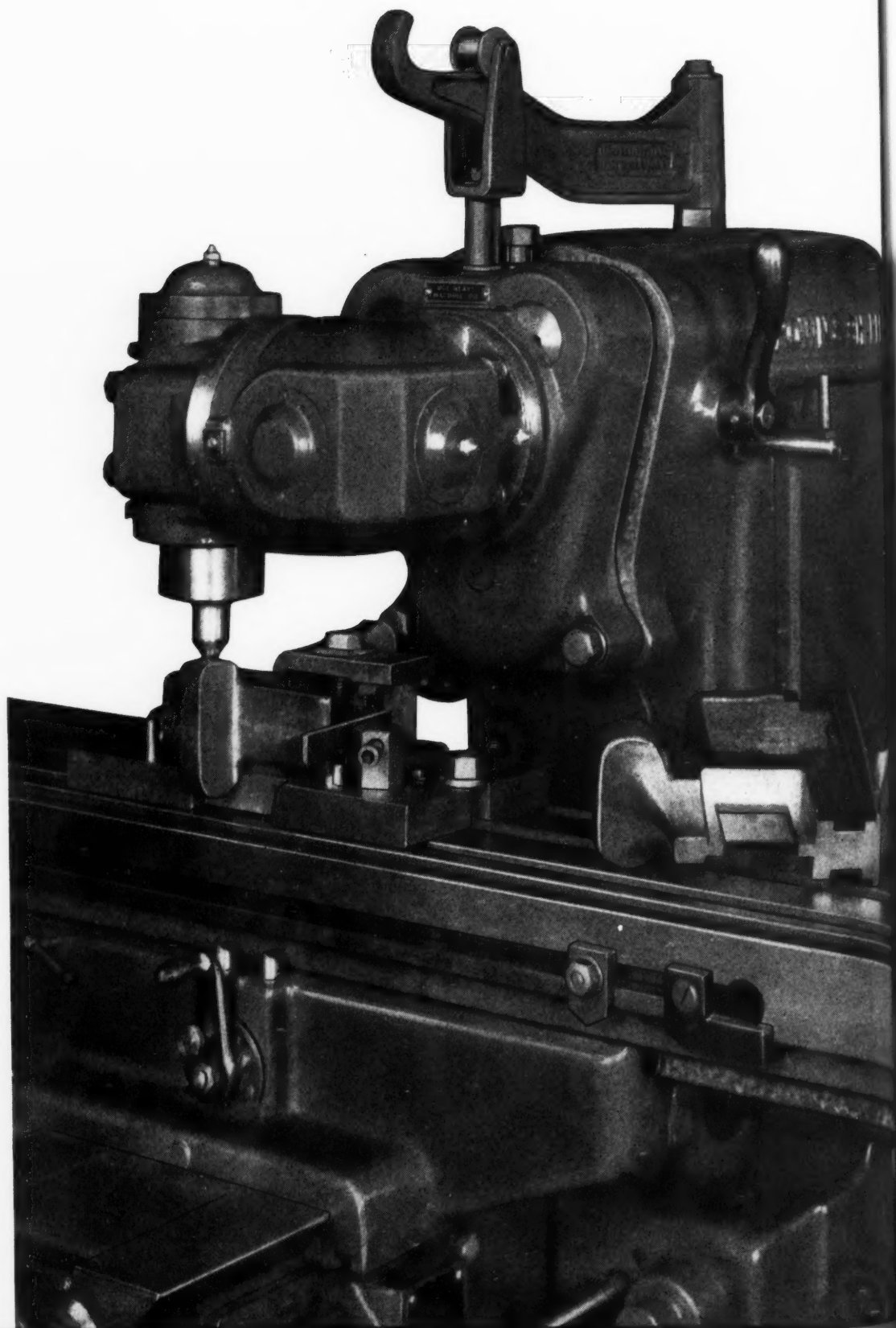
An electrical device intended to be mounted integrally with an indicating pyrometer for controlling fuel-fired or electric

A Profitable Advantage of

BROWN & SHARPE
"LIGHT TYPES"

- Universal
- Plain
- Vertical

. . . noted for
accuracy and rigidity
—yet light, sensitive
and convenient.



BROWN &

BROWN & SHARPE "LIGHT TYPE"

UNIVERSAL and PLAIN MILLING MACHINES

.. No. O UNIVERSAL MILLING ATTACHMENT

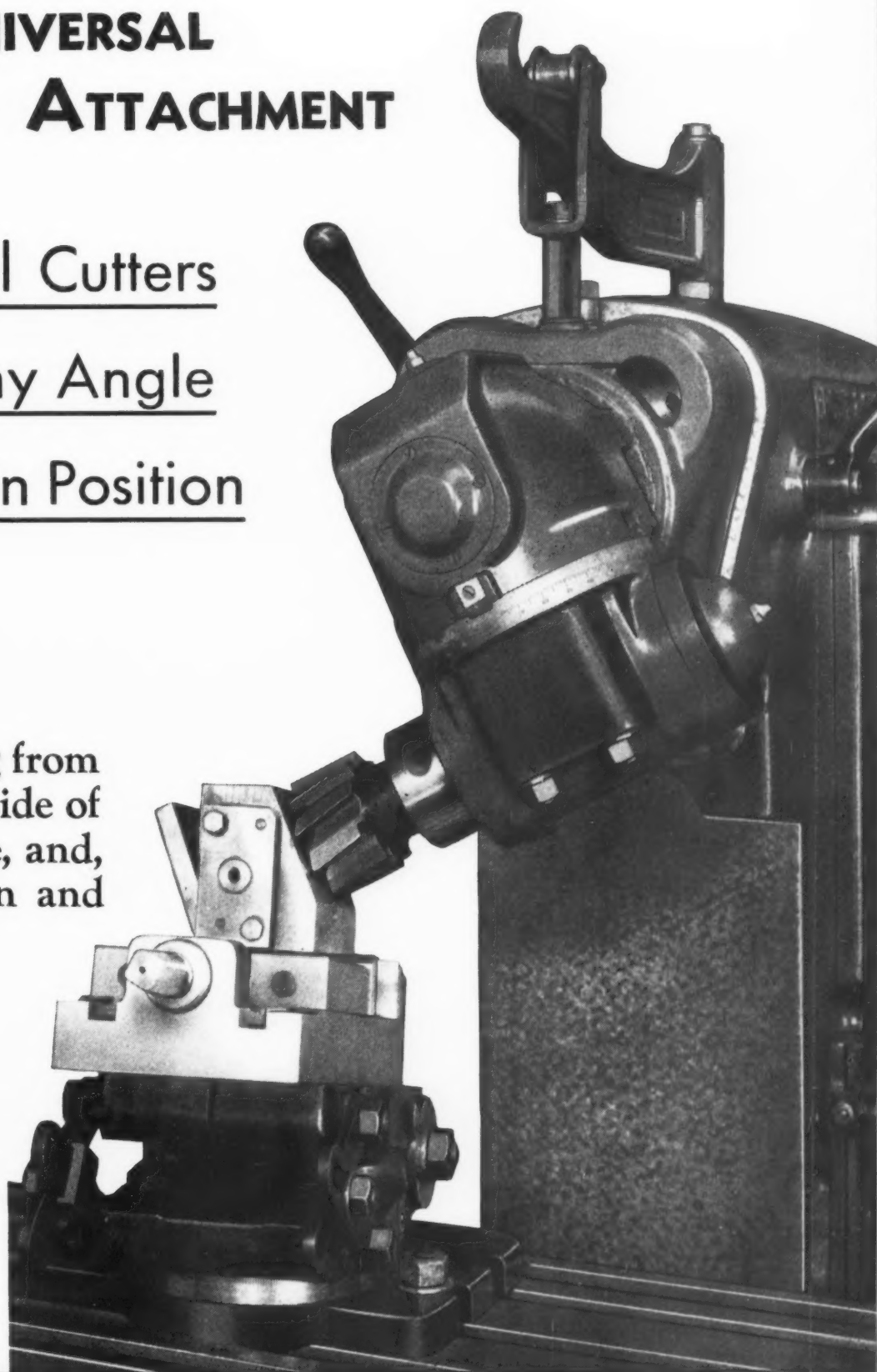
Speeds for All Cutters

Settings to Any Angle

*Easy to Place in Position

*Simply by swinging from storage position at side of machine with crane, and, clamping to column and overarms.

Investigate the many features of these popular "Light Type" machines. Details on request. Brown & Sharpe Mfg. Co. Providence, R.I., U.S.A.



SHARPE

SHOP EQUIPMENT SECTION

heating units that cannot be successfully controlled by means of two- or three-position controllers has been developed by the Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.

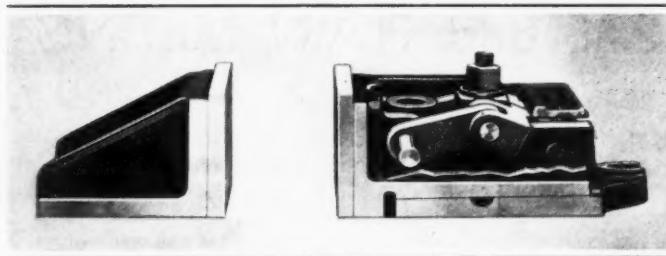
The "Proportioning Capacitrol," as this control is called, operates in conjunction with simple valving or contacting equipment. It achieves the effect of a continuous input variation by varying the ratio of "on" to "off" time in a cycle of predetermined length. The length of the cycle is sufficiently short so that the change in temperature during one cycle is negligible.

This control is said to provide even temperatures, regardless of varying heat requirements, overcome time lag due to slow reaction of furnace temperatures, and balance the heat input against the heat required by the work. This control will be shown at the National Metal Exposition in Atlantic City. 92

Clampco Toggle Type Machine Vise

A vise, designated the Clampco, that can be extended the entire length of a machine tool table to obtain any desired distance between the stationary and movable jaws has been placed on the market by the Howe Machinery Co., Inc., 30 Gregory Ave., Passaic, N. J. As will be seen from the illustration, the stationary jaw is in reality a back-stop which is entirely separate from the movable jaw. This construction adapts the two units for holding wide pieces of work.

The movable jaw of this vise exerts a positive holding pressure on the work through a toggle arrangement. The provision of a toggle link on both sides of the vise makes it possible to clamp a piece on only one corner of the vise without distorting the work. The jaws are about double the usual depth of



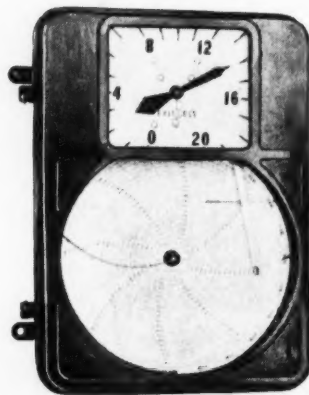
Toggle Type Vise which can be Extended the Full Length of Machine Tool Tables

machine vises, being 3, 3 1/2, and 4 inches deep, respectively, on 4-, 6-, and 8-inch vises. 93

Round-Chart Pyrometer with Dial Indicator

A potentiometer pyrometer, known as the Pyromaster, which is designed for direct marking on a 12-inch round chart and also for scale indication on a large dial has been added to the line of the Bristol Co., Waterbury, Conn. This pyrometer uses standard thermo-couples and extension leads, but operates on a simplified principle.

The operating mechanism consists of (1) a highly dampened sensitive galvanometer, pivoted in jewel bearings; (2) a relay unit, actuated by the galvanometer to operate the motor that balances the electromotive force



Bristol Round-chart Pyrometer with Dial Indicator

from the thermocouple and positions the recording pen arm and scale indicator; (3) a standardizing unit; (4) a "Power Pack"; and (5) the potentiometer or recording and indicating units.

This equipment is available as a recorder, indicator,

recorder with indicating scale, recorder-controller, and recorder-controller with indicating scale. The controllers are made in pneumatic and electric types. 94



Four-Grip Holder for Carbide-tipped and Stellite Tool Bits

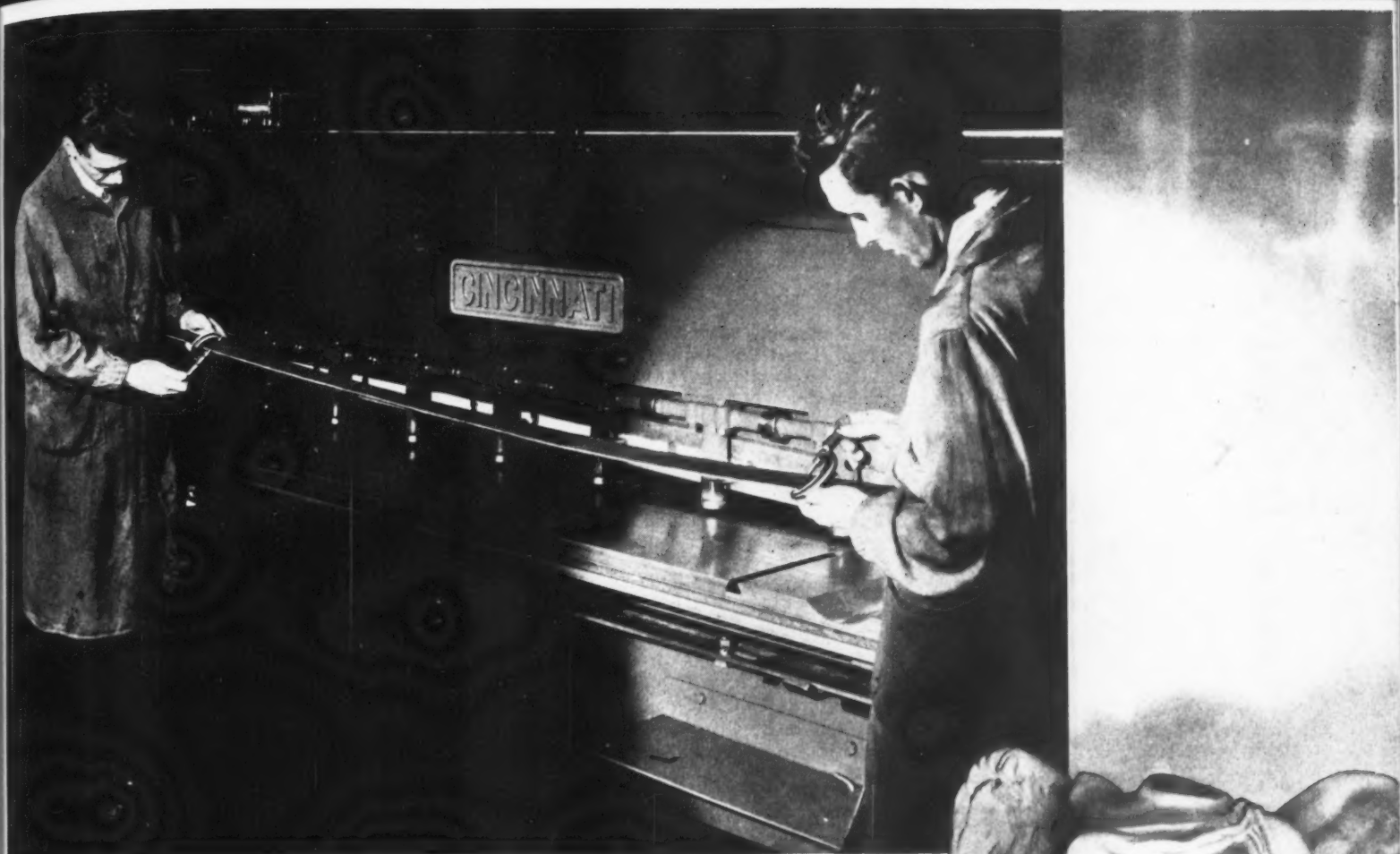
Four-Grip Holder for Carbide-Tipped Tool Bits

The tool-holder here shown has been specifically developed by the Four-Grip Tool Co., 107 E. 17th St., Paterson, N. J., for use with carbide-tipped and Stellite tool bits. The socket hole of this Type TC holder is broached to an angle of 2 degrees to suit tool bits of the types mentioned, whereas holders for high-speed steel bits are broached to an angle of 15 degrees. The new holder is designed to provide the high degree of rigidity essential in the use of brittle cutting alloys. 95

* * *

Index to "Machinery"

The annual index to the forty-third volume of MACHINERY (September, 1936, to August, 1937, inclusive) is ready for distribution. Copies will be sent to readers upon request.



VICTORY

The battle for accurate shearing is won. • Sheets cut to closer limits, sheared with machine tool accuracy, are now available to the trade. • • • • With the Cincinnati Shear you need a micrometer to measure the error.



THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

NEWS OF THE INDUSTRY

California and Utah

THE LINDE AIR PRODUCTS Co., Unit of Union Carbide and Carbon Corporation, New York City, announces the opening of a new sales office at 3710 San Pablo Ave., Oakland, Calif. This office will serve the Oakland area, supplementing the San Francisco office.

CHICAGO PNEUMATIC TOOL Co., 6 E. 44th St., New York City, has opened a direct factory sales and service branch at 119 W. 2nd S. St., Salt Lake City, Utah, with OTTO A. RAY as manager.

Louisiana and Texas

CUTLER-HAMMER, INC., Milwaukee, Wis., manufacturer of electric control apparatus, has appointed JOSEPH GARDBERG manager of the company's new office at 539 Gravier St., New Orleans, La. The office will be operated under the jurisdiction of A. C. Gibson of the Cutler-Hammer Atlanta, Ga., office.

W. E. RAGSDALE has been appointed manager of the Dallas, Tex., office of Cutler-Hammer, Inc., Milwaukee, Wis., manufacturer of electric apparatus. The Dallas office is located at 624 Santa Fe Building.

Michigan

HAMMOND MACHINERY BUILDERS, INC., Kalamazoo, Mich., have appointed the B & H SALES Co., 4980 Potomac St., St. Louis, Mo., representative in St. Louis for the sale of the firm's grinders for foundry and other metal-working use. The company has also appointed C. D. HOLLINS, 2132 Morse Ave., Chicago, Ill., and C. P. GUION, 1661 Milwaukee Ave., Chicago, Ill., representatives in Wisconsin, Illinois, Iowa, and Indiana for the sale of grinders for foundry use. Mr. Hollins and Mr. Guion will handle this representation jointly.

MATHEWS CONVEYER Co., Ellwood City, Pa., has opened a sales-engineering office at Room 319, Curtis Bldg., 2842 W. Grand Blvd., Detroit, Mich. C. E. JEREMIAS and E. A. SMITH will act as field engineers in charge of the office. For the last twenty years, the Mathews Conveyer Co. has been represented in Michigan by the Palmer-Bee Co.

LINCOLN ELECTRIC Co., Cleveland, Ohio, has appointed W. W. McCLELLAN to the sales engineering staff of its Grand

Rapids office., 314 Building and Loan Bldg., Grand Rapids, Mich. Mr. McClellan has previously been engaged in maintenance and general welding for a number of well-known companies.

C. SAM SWANSON has been appointed representative of the Harnischfeger Corporation, Milwaukee, Wis., for the entire state of Michigan, with headquarters at 1702 Kale Bldg., Detroit. Mr. Swanson will handle the company's line of motors and generators.

HERBERT C. BEHRENS, formerly assistant chief engineer in charge of engineering of the Duplex Printing Press Co., Battle Creek, Mich., has been appointed chief engineer of the company in charge of engineering, development, and research.

New England

GENERAL ELECTRIC Co., Schenectady, N. Y., announces that all the plastics activities of the company have been consolidated at the Pittsfield, Mass., plant. G. H. SHILL has been appointed manager of the plastics department, with responsibility for sales, engineering, and manufacturing. K. W. NELSON has been appointed sales manager of the plastics department.

W. A. NEILL has been appointed manager of engineering and sales of the Worthington Pump & Machinery Corporation's plant at Holyoke, Mass. Mr. Neill was formerly manager of the corporation's air tool and portable compressor division at Harrison, N. J.

FAFNIR BEARING Co., New Britain, Conn., announces the bringing out of several new sealed and shielded types of ball bearings, rounding out the company's complete line of self-protected bearings, several types of which have been described from time to time in MACHINERY.

New Jersey

FREDERICK B. HEITKAMP, formerly general sales manager of the American Type Founders, Elizabeth, N. J., has been elected vice-president of that company. Before becoming associated with the American Type Founders in April, 1936, Mr. Heitkamp was vice-president of Lyon Metal Products, Inc., Aurora, Ill., and for several years previously,

general sales manager of the Cincinnati Milling Machine and Cincinnati Grinders Inc., Cincinnati, Ohio.

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J., has a greater number of employees at present than at any time during the last ten years. Employment is 6 per cent above the 1929 figure. Unfilled orders are at the highest level in seventeen years.

New York

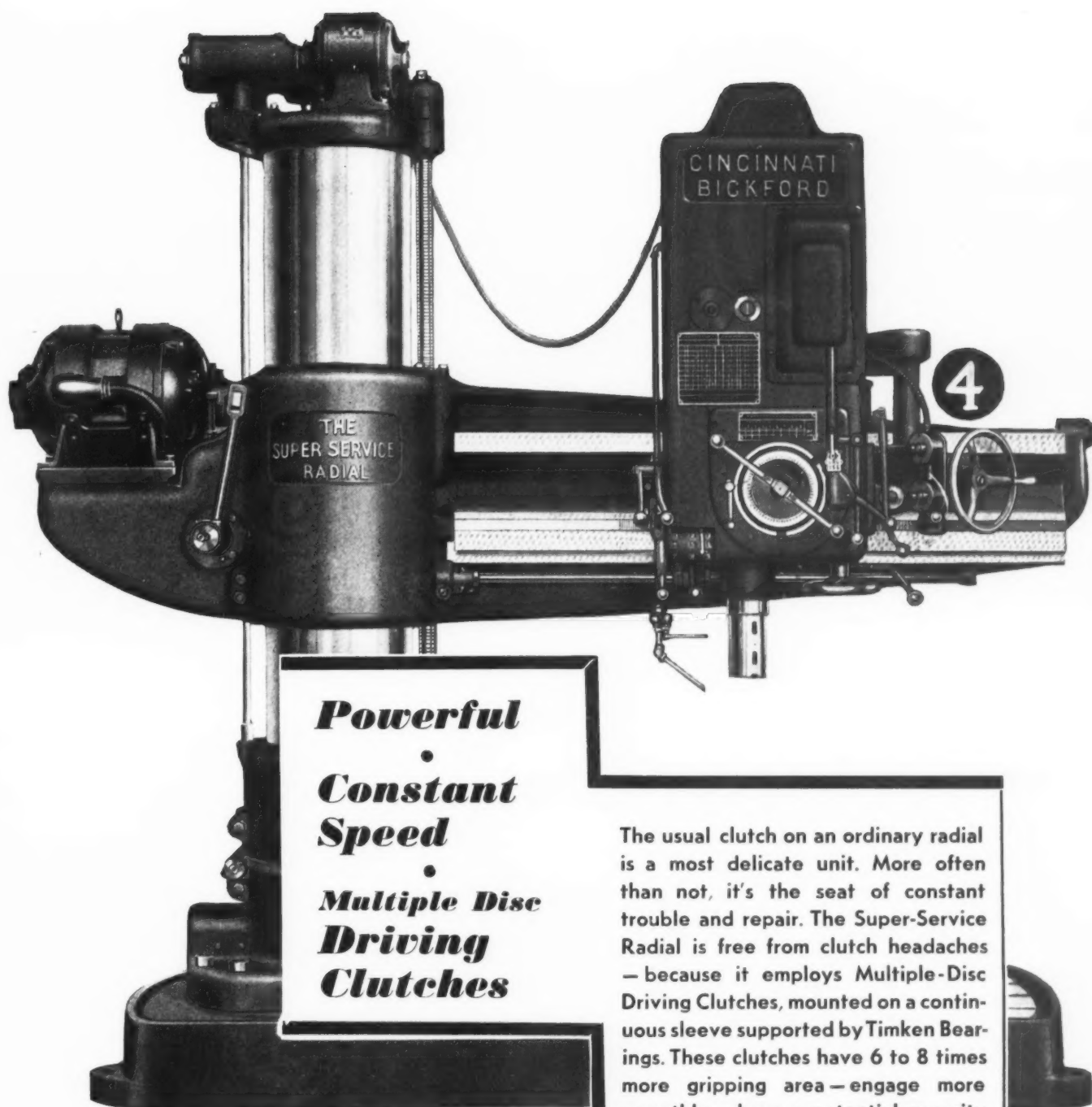
G. R. MUNSCHAUER, on September 14, completed forty years of association with the Niagara Machine & Tool Works, Buffalo, N. Y., manufacturer of presses, shears, and machines for sheet-metal work. The event was made the occasion of a testimonial ceremony and presentation in his honor. During the last forty years, Mr. Munschauer has actively served in all divisions of the business. He became president and general manager in 1918.

GENERAL ELECTRIC Co., Schenectady, N. Y., has installed a new electric furnace laboratory, where investigations and experiments will be made on electric heat-treating equipment. In addition to development work, an important service performed by this laboratory will be the demonstration of the latest developments in electric heat-treatment. Industrial executives and metallurgists are invited to visit the laboratory.

THOMAS PROSSER & SON, 15 Gold St., New York City, dealers in fine steels, mechanical specialties, and machinery, announce that the partnership of the firm heretofore consisting of Richard Prosser and Roger D. Prosser has been dissolved by the death of Richard Prosser last July. Roger D. Prosser will continue to conduct the business under the name of Thomas Prosser & Son.

C. H. BOENIG, Youngstown, N. Y., has been appointed sales engineer by the Harnischfeger Corporation, Milwaukee, Wis., and will handle the entire line of Harnischfeger products, including truck cranes, overhead cranes, electric hoists, Smootharc welders and welding rod. He will cover the entire western section of the state of New York, with Rochester, N. Y., as the eastern boundary line of the territory.

GENERAL ELECTRIC Co., Schenectady, N. Y., on September 20, began a five-day course in industrial heating practices and applications. More than one hundred power salesmen from leading electric service companies in various parts of the country were in attendance. Attention was focussed not only on new types of equipment available, but also on potential markets for industrial heating.



***Powerful
•
Constant
Speed
•
Multiple Disc
Driving
Clutches***

**Six Features of the
Super-Service RADIAL**

- ① All Controls Conveniently Low and Centralized
- ② 36 Speeds in Geometrical Progression
- ③ 18 Feed Changes in Geometrical Progression
- ④ Constant Speed Multiple-disc Driving Clutches
- ⑤ Extra long Spindle Bearing for Strength and Accuracy
- ⑥ Herringbone Spindle Driving Gears

The usual clutch on an ordinary radial is a most delicate unit. More often than not, it's the seat of constant trouble and repair. The Super-Service Radial is free from clutch headaches — because it employs Multiple-Disc Driving Clutches, mounted on a continuous sleeve supported by Timken Bearings. These clutches have 6 to 8 times more gripping area — engage more smoothly — have a potential capacity much greater than that of the driving motor. Less adjusting is required. They operate at a constant R.P.M. and deliver the same, maximum, uniform, dependable power — at any spindle speed! There are many more Super-Service Radial points of excellence; bulletin R-24 explains them all in an interesting manner. Send for it.

**THE
CINCINNATI BICKFORD
TOOL COMPANY
Oakley, Cincinnati, Ohio**

WAYNE Z. FRIEND has joined the development and research staff of the International Nickel Co., Inc., 67 Wall St., New York City. Mr. Friend will devote most of his time to technical service on corrosion-resisting materials, particularly Monel, nickel and Inconel. He is a graduate of West Virginia University, class of 1926.

HOWARD V. HARDING has been appointed district sales manager of Lukens Steel Co., Division of Lukens Steel Co., Coatesville, Pa. His headquarters will be at 120 Liberty St., New York City. For the last ten years, Mr. Harding has been chief engineer of Peter Clark, Inc., New York City.

REED-PRENTICE CORPORATION, Worcester, Mass., announces that the corporation will handle the sales of plastic injection molding machines directly in the New York territory. The New York office is located in Room 1101, 75 West St., with George W. McIntyre as manager.

WESTCOTT CHUCK CO., Oneida, N. Y., announces that J. C. HARVEY has been added to the company's organization as special representative. Mr. Harvey will cooperate with the Westcott distributors in the various sales territories.

Ohio

REPUBLIC STEEL CORPORATION, Cleveland, Ohio, has appointed the following new distributors for the corporation's tubular products: BLUEFIELD SUPPLY CO., Bluefield, W. Va.; ORMAND PLUMBING SUPPLY CO., San Antonio, Tex.; J. GABER CO., Houston, Tex.; and MORGAN'S INC., Savannah, Ga.

AMALGAMATED STEEL CO., Cleveland, Ohio, has recently moved into new quarters in the Newburgh Mill District of that city. The company manufactures Malga non-tempering steel, especially developed for pneumatic tool requirements.

MANUFACTURERS AND FABRICATORS, INC., 4389 Martin Ave., Cleveland, Ohio, was recently organized as a contract shop for the manufacture and fabrication of iron and steel products.

EMERSON ELECTRIC MFG. CO., St. Louis, Mo., announces that its Cincinnati office and warehouse are now located at 457 E. 6th St., Cincinnati, Ohio. Jack Searls is in charge.

Pennsylvania

PITTSBURGH TOOL-KNIFE & MFG. CO., Pittsburgh, Pa., recently moved into its own newly equipped plant at 75-81 Sycamore St., Etna P. O., Pittsburgh.

Pa. The main two-story plant is devoted entirely to the production of metal-cutting saws, rivet sets, paper knives, chisel blanks, and inserted-tooth saws. A new office building has been erected adjoining the plant.

WALTER P. LOTZ has been appointed sales manager of the Standard Tool Division of William Sellers & Co., Inc., Philadelphia, Pa., to supplement the activities of Edward L. Holljes, sales manager. Mr. Lotz will be in charge of agency distribution activities on the company's standard line of grinders, planers, and horizontal boring machines.

FRANK CAMPBELL COE, sales engineer, Commercial Trust Bldg., 15th and Market Sts., Philadelphia, Pa., has been appointed representative of Graham Transmissions, Inc., in eastern Pennsylvania, southern New Jersey, Maryland, Delaware, and the District of Columbia.

W. P. WHITE, 1208 N. Broad St., Philadelphia, Pa., has been appointed district manager in charge of steel and tube sales in the eastern and southern Pennsylvania district by the Steel and Tube Division of the Timken Roller Bearing Co., Canton, Ohio.

West Virginia and Maryland

LINCOLN ELECTRIC CO., Cleveland, Ohio, manufacturer of arc-welding equipment, has opened a sales engineering office at 400 North St., Bluefield, W. Va. The new office will be under the charge of WILLIAM H. SCHUSTER, who, for the past year, has been assistant welding instructor in the Lincoln Welding School at Cleveland. He will maintain welding consultation and supply service for the coal fields of West Virginia, Virginia, and Kentucky.

STEEL & TUBES, INC., a subsidiary of the Republic Steel Corporation, Cleveland, Ohio, has opened a branch office at Baltimore, Md., which will handle the entire line of Steel & Tubes products. H. H. SMITH is in charge of the new office.

Wisconsin, Illinois and Iowa

P. C. DAY has been made vice-president of the Falk Corporation, Milwaukee, Wis. For several years, Mr. Day was in charge of the West Drayton Gear Works of the Power Plant Co., in England. In 1910, he became connected with the Falk Corporation as chief engineer, directing the work of helical and herringbone gearing developments. He will remain in charge of engineering with the title "vice-president-chief engineer."

ALLEN-BRADLEY CO., Milwaukee, Wis., manufacturer of motor control equip-

ment, has appointed the DELAVAN ENGINEERING CO., 414 S. Twelfth St., Des Moines, Iowa, representative in the Iowa territory. The WILSON ELECTRICAL EQUIPMENT CO., 2009 Capitol Ave., Houston, Tex., has been appointed representative in the southern territory.

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill., has enlarged its plant, offices, and engineering department by an addition covering 8000 square feet. This addition will greatly increase the productive capacity of the plant. It has been fully equipped with the most modern machine tools.

DELAVAN ENGINEERING CO., 414 Twelfth St., Des Moines, Iowa, has been appointed sales representative in the states of Iowa and Nebraska for the TRICO FUSE MFG. CO., Milwaukee, Wis., handling the company's complete line of fuses, clamps, fuse pullers, and lubricators.

NEW BOOKS

HOW TO MAKE ALIGNMENT CHARTS. By Merrill G. Van Voorhis. 114 pages, 6 by 9 inches; 78 illustrations. Published by the McGraw-Hill Book Co., Inc., New York City. Price, \$2.50.

It is the purpose of this volume to provide definite instructions on how to make nomographic or alignment charts for the solution of engineering and other formulas. In preparing the material, stress has been placed on how to handle the various types of equations. When the theory of construction is not essential to the understanding of the procedure in making the charts, it has not been interspersed in the main section of the book. However, the theory is briefly outlined for reference in an appendix. Graphical construction methods are described wherever they are practical, along with the mathematical method.

FOREMAN AND APPRENTICE TRAINING IN FOUNDRIES. Proceedings of forty-first annual convention of the American Foundrymen's Association, published as Management Series of the Association No. 2, 1937. 57 pages, 6 by 9 inches. Published by the American Foundrymen's Association, Inc., 222 W. Adams St., Chicago, Ill. Price, \$1.

GOGGLES—SAFE PRACTICE PAMPHLET No. 14. 7 pages, 8 1/2 by 11 inches. Published by the National Safety Council, Inc., 20 N. Wacker Drive, Chicago, Ill.



Presenting
THE PROCUNIER
UNIVERSAL
TAPPING MACHINE

featuring

Five tapping speeds—385, 600, 935, 1450 and 2240 R.P.M.

Preset tapping and reversing pressures, maintained accurately uniform by long helical springs—independent of operator.

Capacity from No. 8 to $\frac{5}{8}$ " using two interchangeable heads.

Automatic lubrication of tap while cutting only, with flexible timing and volume adjustments.

Procunier Tru-Grip Tap Holder.

Procunier Sensitive High Speed Tapping Heads.

Precision hand-screw height adjustment of working table.

Precision depth-stop adjustment with $\frac{1}{32}$ " graduated indicator.

Whether your tapping requirements demand greater flexibility, higher production, increased accuracy or maximum capacity range, the Procunier Universal offers matchless value.

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 for Catalog
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 16 South Clinton Street
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COMING EVENTS

OCTOBER 4-6—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Lawrence, Erie, Pa. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 4-9—POWER AND MECHANICAL ENGINEERING EXPOSITION at the International Amphitheater, Chicago, Ill. Further information can be obtained from the Executive Offices of the Exposition, Grand Central Palace, New York City.

OCTOBER 7-9—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Ambassador Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 11-15—NATIONAL SAFETY CONGRESS in Kansas City, Mo. For further information, address National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 18-22—NATIONAL METAL CONGRESS AND EXPOSITION to be held in the Atlantic City Auditorium, Atlantic City, N. J., under the auspices of the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 18-22—Eighteenth annual meeting and exposition of the AMERICAN WELDING SOCIETY at Atlantic City, N. J.; headquarters, Hotel Traymore. Secretary, M. M. Kelly, 33 W. 39th St., New York City.

OCTOBER 19—Meeting of the Machine Shop Practice Division of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in conjunction with the American Welding Society's annual meeting at Atlantic City, N. J. C. E. Davies, secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

OCTOBER 27-NOVEMBER 3—NATIONAL AUTOMOBILE SHOW, at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

NOVEMBER 10-12—Thirty-eighth annual convention of the INTERNATIONAL ACETYLENE ASSOCIATION at the Hotel Tutwiler, Birmingham, Ala. For further information, address International Acetylene Association, 30 E. 42nd St., New York City.

DECEMBER 6-10—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Societies Building, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 6-11—SIXTEENTH EXPOSITION OF THE CHEMICAL INDUSTRIES to be held at Grand Central Palace, New York City, under the direction of Charles F. Roth, Grand Central Palace, New York City.

DECEMBER 8-10—National Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Flint, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 21-25, 1938—WESTERN METAL EXPOSITION AND CONGRESS, in the Pan-Pacific Auditorium, Los Angeles, Calif., under the auspices of the American So-

ciety for Metals. W. H. Eisenman, managing director, 7016 Euclid Ave., Cleveland, Ohio.

MAY 14-19, 1938—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago, Ill.

JUNE 20-24, 1938—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

OBITUARIES

Herman Diederichs

Herman Diederichs, dean of the College of Engineering and chairman of the Board of Athletic Control, Cornell University, died August 31 at the Sanatorium, Clifton Springs, N. Y., aged sixty-three years. He had been in poor health for the past year.

For forty-four years, Dean Diederichs was identified with Cornell University—first as student, then as teacher and professor, and since July 1 last year as dean of the engineering colleges. He began as a poor German immigrant boy, and at his death held one of the highest posts in American engineering education. He was an authority in experimental engineering, with special reference to the properties of materials. In 1910, he published a text-book on this subject, in collaboration with the late

Professor R. C. Carpenter, which has passed through several editions and is still considered a standard work in its field. He was also co-author, with W. C. Andrae, of an extensive work on mechanical experimental engineering (published in 1931), dealing with engineering instruments.

In 1930 Dean Diederichs was awarded the Melville medal of the American Society of Mechanical Engineers. He acted as a consultant in industry, and in that capacity performed many investigations and tests. Throughout his career on the Cornell faculty, Dean Diederichs took a deep interest in student activities, especially in athletics.

CHARLES NEAVE, counsel and member of the board of directors of the General Electric Co., Schenectady, N. Y., died September 10 at his home in Ossining, N. Y., aged sixty-nine years. Mr. Neave had been counsel for the General Electric Co. for the last thirty-five years and was elected a member of the board of directors in March, 1936. He was a member of the firm of Fish, Richardson & Neave.

Gear Manufacturers' Semi-Annual Meeting

The American Gear Manufacturers' Association held its semi-annual meeting at the Spink-Wawasee Hotel, Lake Wawasee, Ind., September 20 to 22. As usual, standardization activities occupied the larger part of the program, standardization having always been one of the Association's main objectives.

In addition to the standardization reports presented by the standing committees, the following papers were read before the meeting: "Torch-Hardening Method for Gears" by W. E. Sykes, Farrel-Birmingham Co., Inc.; "Relation between Microstructure and Machineability of Gear Steels" by Dr. N. E. Woldman, Eclipse Aviation Corporation; "Roller Tests to Determine Pitting Fatigue Strength" by Dr. Steward Way, Westinghouse Electric & Mfg. Co. Research Laboratories; "The Credit Situa-

tion" by Paul Fielding, National Credit Association; "Electric Motors" by L. R. Botsai, Westinghouse Nuttall Works; "Valuation of Jobs Based on Community Rates" by A. S. Crockett, General Electric Co.; and "Our Relations with Other Associations" by T. R. Rideout, Westinghouse Nuttall Works. Abstracts of several of these papers will be published in coming numbers of MACHINERY.

* * *

A booklet entitled "Five Ways to Buy Equipment" has been published by the Commercial Investment Trust, Inc., 1 Park Ave., New York City. It compares what might be called conventional financing methods with the equipment funding plan inaugurated by the Commercial Investment Trust.

NEWS OF THE INDUSTRY

Alabama and Texas

H. P. LADDS, vice-president and general manager of the Lamson & Sessions Bolt Co., Birmingham, Ala., has resigned, and will be succeeded by GEORGE S. CASE, JR., vice-president and general manager of the Lamson & Sessions Co., Chicago, Ill. WILLIAM M. OLSEN has been made vice-president and general manager of the Chicago subsidiary. He was previously manager of the stove bolt and machine screw sales department in Cleveland. G. RIDER NEFF, who has been engaged in sales work since 1930, has been promoted to the position of manager of the stove bolt and machine screw sales department. ALEXANDER M. SMITH, for the last three years in charge of the experimental and development department, has been made assistant general manager of the Lamson & Sessions Chicago subsidiary.

JOHNSON BRONZE Co., New Castle, Pa., manufacturer of bronze bearings and bushings, has appointed CONNELL-ROPER, INC., 2816 Commerce St., Dallas, Tex., sales representative of the company in the southwest territory.

California

GEORGE H. CORLISS, advertising and sales promotion manager for the last four years of the Lewis-Shepard Co., Boston, Mass., manufacturer of material-handling equipment, has been appointed regional manager of the company, with headquarters at 1401 Sante Fe Ave., Los Angeles, Calif.

Illinois

WILLIAM C. CARTER and EDWARD J. BURNELL were elected vice-presidents of the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., at a recent meeting of the board of directors. Mr. Carter has been connected with the company since 1902, having started as a draftsman. In recent years, he has been in charge of company production, with headquarters in Chicago. Mr. Burnell has been connected with the company since 1913, also starting as a draftsman. Recently he has acted as general manager of the Pershing Road Chicago plant.

FRANK J. MILLER has been made manager of the Chicago sales and engineering office at 230 N. Michigan Ave. of New Departure Division of General Motors Corporation, Bristol, Conn., to take

the place of the late G. W. Fowler. Mr. Miller has been associated with the sales activities of the company in the Chicago territory for over eighteen years.

G. S. BLAKESLEE & Co., 119th St. and 52nd Ave., Chicago, Ill., manufacturers of degreasing machines and metal parts washers, announce that construction has been started on a two-story addition to its plant, which will give a 50 per cent increase in manufacturing floor space and will double the available office space.

WILLIAM J. KELLY, president of Arthur J. O'Leary & Son Co., Chicago, Ill., manufacturer of iron and steel products, has



William J. Kelly, New President of the Machinery and Allied Products Institute

been elected president of the Machinery and Allied Products Institute, 221 N. La Salle St., Chicago, Ill.

D. D. FENNELL, consulting engineer of Chicago, has been elected president of the National Safety Council, whose headquarters are located at 20 N. Wacker Drive, Chicago, Ill.

JOHN E. WELLS has been appointed advertising and sales promotion manager of the Gatke Corporation, 228 N. La Salle St., Chicago, Ill., manufacturer of automotive timing gears, molded brake linings, non-metallic bearings, asbestos textile products, etc. Mr. Wells formerly handled advertising and sales promotion activities for the Ex-Cell-O Corporation, Detroit, Mich., in which capacity he was employed for a period



John E. Wells, Advertising and Sales Promotion Manager of the Gatke Corporation

of eight and one-half years. Previous to that time he was a sales engineer for the Robbins & Myers Co., Springfield, Ohio; the Chicago Fuse Co., New York City; and the Triangle Conduit Co., New York City.

Indiana

THE LINDE AIR PRODUCTS COMPANY, Unit of Union Carbide and Carbon Corporation, 205 E. 42nd St., New York City, has removed its Indianapolis office to a new fireproof office building at 729 N. Pennsylvania St., Indianapolis, Ind. The new quarters provide space both for the district office and for a repair and service station for Oxyweld oxy-acetylene welding and cutting apparatus.

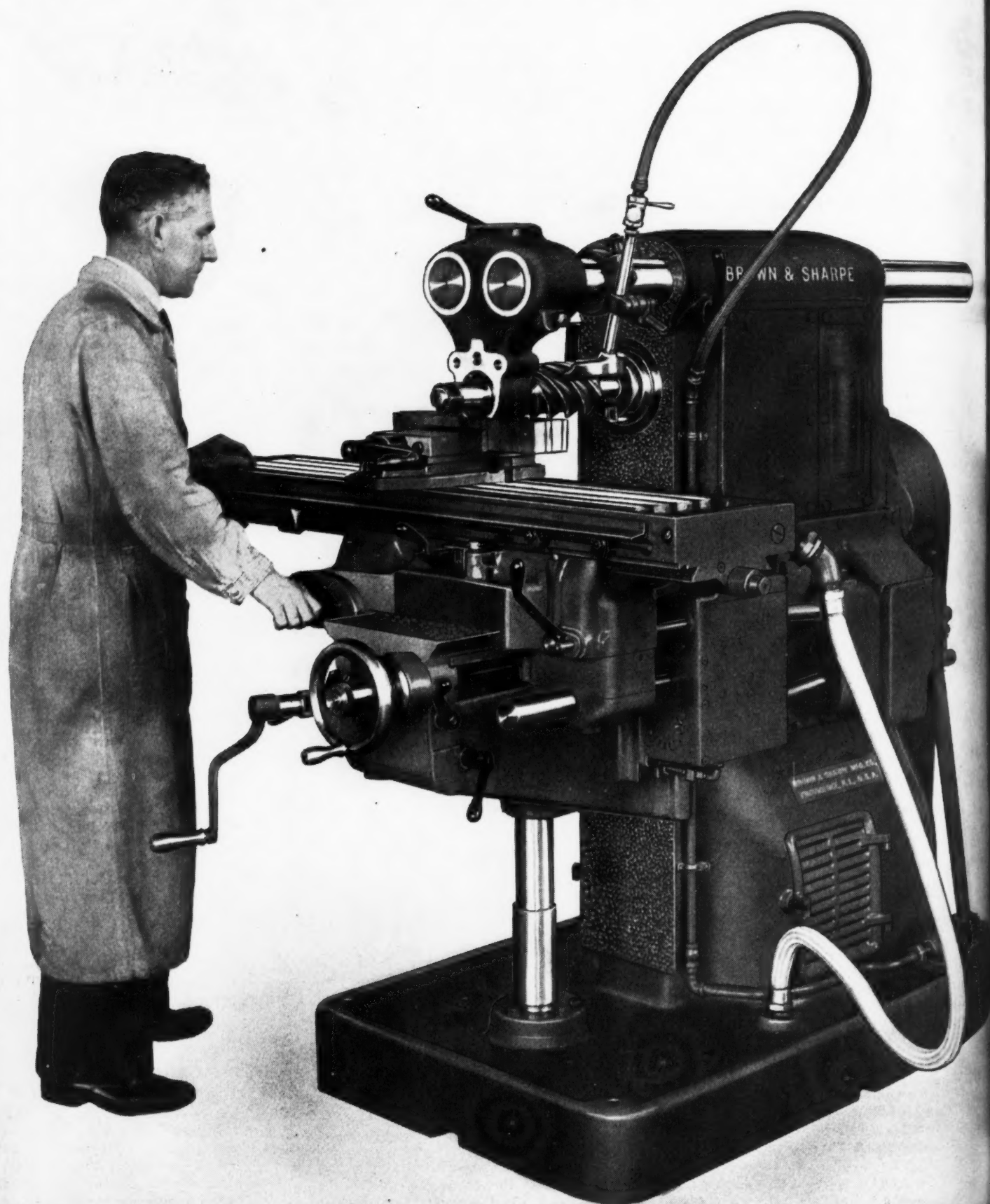
H. B. KAULE, who has been head of the Arnold, Pa., extrusion department of the Aluminum Co. of America for the last three years, has been promoted to the position of superintendent of the new extrusion works now being built at Lafayette, Ind.

ALEXANDER W. LIMONT, JR., has been appointed manager of the Compressor Division of the Sullivan Machinery Co. at Michigan City, Ind.

Michigan

ROBINSON WELDING SUPPLY Co., 1921 E. Ferry St., Detroit, Mich., is a new service organization with warehousing facilities that will provide prompt supply service of arc-welding machines, electrodes, and accessories in the Detroit territory. The company was formed by J. M. Robinson, who for the last twelve years has been Detroit dis-

Modern - - - High Speed



BROWN &

DUAL CONTROL and STANDARD Types

Dual Control Type (below)

... All controls — power and hand — at **both front and rear**. Wide feed range.

Standard Type (opposite page)

... Power controls at both front and rear. Hand controls at front.



A Profitable Investment is

assured by the purchase of these highly productive Milling Machines —furnished in either Dual Control or Standard Types in the following sizes: 2A and 3A Universal — 2B and 3B Plain. Ask for specifications. Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

SHARPE

trict manager for the Lincoln Electric Co., Cleveland, Ohio. The Robinson Welding Supply Co. will handle Lincoln Electric Co.'s products exclusively, including "Shield-Arc" SAE welders and Lin-Weld motors, together with electrodes and other arc-welding accessories and supplies.

F. M. MAICHLE has been appointed manager of the Detroit arc-welding sales-engineering office at 10228 Woodward Ave., of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc-welding equipment. He was previously manager of the company's Pittsburgh office. Mr. Maichle will be assisted by C. H. BUCKMASTER, J. F. CUNNINGHAM, N. B. GILLILAND, T. A. STEEL, and F. E. BOUCHER in providing a complete welding supply and consultation service.

VIRGIL W. MCDANIEL has been appointed general sales manager of the Eclipse Counterbore Co., Detroit, Mich., manufacturer of interchangeable-end cutting tools, succeeding J. E. MACARTHUR, who recently resigned. Mr. McDaniel was previously connected with the Parts Division of the Chrysler Corporation. All industrial sections of the United States and Canada will be under his direct supervision.

B. L. DIAMOND has been appointed Detroit representative for the MODERN TOOL WORKS DIVISION OF CONSOLIDATED MACHINE TOOL CORPORATION, Rochester, N. Y., succeeding FORD R. LAMB, who is now executive secretary of the American Society of Tool Engineers. Mr. Diamond will maintain offices at 6560 Epworth Blvd., Detroit, Mich.

CARBOLLOY COMPANY, INC., 2985 E. Jefferson Ave., Detroit, Mich., has recently purchased a 40-acre tract of land just outside the limits of Detroit on which it is planned to build a factory for manufacturing cemented-carbide tools, dies, and wheel-dressers.

New England

F. O. HOAGLAND, master mechanic of the Pratt & Whitney Division of the Niles-Bement-Pond Co., Hartford, Conn., has been elected a vice-president of the American Society of Mechanical Engineers, to assume office at the annual meeting in December.

HERMAN L. TYGESSON has become associated with the Kron Co., Bridgeport, Conn., manufacturer of industrial dial scales, in the capacity of general superintendent. WARNER DEFOE has been transferred to the Bridgeport office to act as purchasing agent.

TORRINGTON MFG. CO., Torrington, Conn., is increasing its manufacturing facilities in order to take care of the increased production of the company's new line of spring-making machines.

THE LINDE AIR PRODUCTS COMPANY, Unit of Union Carbide and Carbon Corporation, 205 E. 42nd St., New York City, announces that its Boston district office has moved to 441 Stuart St., Boston, Mass.

New York and New Jersey

H. SIDNEY SMITH has been awarded the Samuel Wylie Miller medal by the American Welding Society for meritorious contributions to the science and art of welding. Mr. Smith is well known in the acetylene industry, both in America and abroad. He has served as president of the British Acetylene Association and of the International Acetylene Association. He has been responsible for many important developments in acetylene utilization. Since 1918, he has been consulting engineer for the Union Carbide and Carbon Corporation, New York.

W. C. REID, formerly midwestern manager, with offices in Chicago, of the Metallizing Engineering Co., Inc., 44 Whitehall St., New York City, has been appointed vice-president in charge of sales and will make his headquarters at the main offices in New York. WALTER B. MEYER, formerly manager of the St. Louis office, has been made manager of the Chicago office. ALAN B. GEUDER, formerly connected with the Chicago office as a salesman, will take over Mr. Meyer's duties in St. Louis.

HARTE COOKE, mechanical engineer of the McIntosh & Seymour Corporation, Auburn, N. Y., has been elected a vice-president of the American Society of Mechanical Engineers, to assume office at the annual meeting in December.



G. R. Munschauer, President and General Manager, Niagara Machine & Tool Works, Buffalo, N. Y., Who Recently Completed Forty Years with the Company

CARL L. BAUSCH, vice-president of Bausch & Lomb Optical Co., Rochester, N. Y., has been elected manager of the American Society of Mechanical Engineers for a three-year term.

WESTINGHOUSE ELECTRIC ELEVATOR CO., Chicago, Ill., has acquired the assets, business, and good will of the A. B. SEE ELEVATOR CO., INC., 150 Pacific Ave., Jersey City, N. J., and has removed the headquarters of the company from Chicago to Jersey City.

Ohio

RALPH L. WILSON, formerly metallurgical engineer with the Timken Steel and Tube Division of the Timken Roller Bearing Co., Canton, Ohio, has become associated with the Climax Molybdenum Co., 500 Fifth Ave., New York City, in the capacity of metallurgical engineer in the development field. Mr. Wilson's headquarters will be at the Canton, Ohio, office of the Climax Molybdenum Co.

SALEM ENGINEERING CO., Salem, Ohio, announces the appointment of LATIMER KOVARIK, 408 S. Graham St., Pittsburgh, Pa., as Pittsburgh territory representative of the company. PRESLEY HAMILTON, 149 Broadway, New York, has been appointed New York district representative.

C. W. SPICER, vice-president of the Spicer Mfg. Corporation, Toledo, Ohio, has been nominated for president of the Society of Automotive Engineers for 1938. E. N. SAWYER, production engineer, Cleveland Tractor Co., Cleveland, Ohio, has been nominated for vice-president in charge of the Production Division of the Society.

PHILIP E. BLISS, president of the Warner & Swasey Co., Cleveland, Ohio, has been appointed a member of the board of trustees of the Case School of Applied Science, of Cleveland, to fill the vacancy left by the death of Ambrose Swasey last June.

SMITH POWER TRANSMISSION CO., announces that it is now located at 410 Lakeside Ave., N. W., Cleveland, Ohio. The company acts as direct representative for ten prominent manufacturers of power transmission equipment.

Pennsylvania and Maryland

W. R. PERSONS has been appointed manager of Pittsburgh welding sales for the Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc-welding equipment. Mr. Persons will be assisted by J. H. PAINTER, M. S. SCHONVIZNER, R. H. SHUSTER, and H. E. WHITE. Complete supply and consultation service will be offered to users of welding equipment at the Pittsburgh office.



Speed and accurate performance
are essential to successful shear-
ing. • Cincinnati All-Steel
Shears cut at high speeds with
machine tool accuracy. • • •



THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO



J. M. McKibbin, Jr., Apparatus Advertising and Sales Promotion Manager of the Westinghouse Electric & Mfg. Co.

J. M. McKIBBIN, JR., has been appointed apparatus advertising and sales promotion manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. McKibbin has been connected with the company since 1922, and has served in various advertising sales promotion and industrial sales capacities.

JOHN MCC. LATIMER, Koppers Bldg., Pittsburgh, Pa., has been appointed exclusive representative in the western Pennsylvania territory for **LUKENWELD, INC.**, Coatesville, Pa., designer and builder of welded steel structures.

H. MCE. PATTON has joined the staff of the Research and Development Division of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa. He was formerly with the Pittsburgh Steel Co.

J. A. HUNT CO., 2036 Sansom St., Philadelphia, Pa., has been appointed district representative for the **KRON CO.**, Bridgeport, Conn., manufacturer of industrial dial scales.

GLEN H. TRESLAR has been appointed assistant sales manager of the **Black & Decker Mfg. Co.**, Towson, Md.

Wisconsin and Minnesota

CUTLER-HAMMER, INC., 12th and St. Paul Ave., Milwaukee, Wis., manufacturer of electric control apparatus, announces the following appointments: **E. T. REES** has been made manager of the branch sales office at 307 N. Pennsylvania Ave., Indianapolis, Ind.; **E. F. WEISS**, manager of the Detroit office, located at 2755 E. Grand Blvd.; **F. J. WOLDRICH**, manager of the new branch sales office at 625 N.W. Everett St., Portland, Ore.; and **A. R. JOHNSON**, manager of the Merchandising Sales Division of the company, in charge of distributor sales.

McCULLOCK SALES CO., 712 Western Ave. South, Minneapolis, Minn., has been appointed exclusive agent in the state of Minnesota for **P & H** motors, manufactured by the **Harnischfeger Corporation**, Milwaukee, Wis.

OBITUARIES

ERNEST J. LEES, vice-president and chief engineer of the National Tool Co., Cleveland, Ohio, died suddenly on September 27. Mr. Lees was well known in the machine tool industry, having been prominently identified with the development of gear-cutting machinery. For many years, he was with the **Lees-Bradner Co.**, Cleveland, Ohio, but about five years ago he left that company and later went with the **National Tool Co.**

Mr. Lees was identified with the design of helical and worm gear drives for various purposes; spur and helical gear generating machines; hobs for generating sprockets for chain drives; thread milling machines for precision thread milling; and with the design of the first commercial gear generating grinder marketed in the United States. He also designed gear testing machines and a six-spindle full automatic machine for making twist drills from the bar, as well as a great many other machines and devices.

WILLIAM L. RICKARD, head of the advertising agency of **Rickard & Co., Inc.**, 330 W. 42nd St., New York City, died on October 5 at the White Plains Hospital in White Plains, N. Y. Mr. Rickard was born in New York, and started his business career thirty-five years ago with the **Otis Elevator Co.** in the sales department. He later became manager of export sales, which position he held for several years before becoming vice-president of the advertising agency of **Ray D. Lillibridge, Inc.**

In 1912, he and **Clifford Sloan**, brother of **Alfred P. Sloan**, chairman of the board of **General Motors Corporation**, formed the advertising agency of **Rickard & Sloan, Inc.**, located at 20 Vesey St., New York City. Two years ago, Mr. Sloan retired, and the firm then became **Rickard & Co., Inc.**

CHARLES E. HILDRETH, well-known retired machine tool manufacturer, died October 6 at the age of seventy years. Mr. Hildreth was a graduate of **Amherst College**, class of 1892. After graduation, he entered the firm of **P. Blaisdell & Co.**, Worcester, Mass., and in 1895, became vice-president and treasurer of the **Whitcomb-Blaisdell Machine Tool Co.** of the same city, of which company he later became president and general manager. He was for many years general man-

ager of the **National Machine Tool Builders Association**, and also served as counselor of the **National Metal Trades Association**.

HOWARD C. HUNT, vice-president and treasurer of the **National Automatic Tool Co.**, Richmond, Ind., died on September 22 from complications following an appendicitis operation. He was forty-seven years old. Mr. Hunt was born and reared in Richmond and attended **Earlham College**. He was connected with **Dun & Bradstreet** at Cincinnati, Ohio, for several years before becoming affiliated with the **National Automatic Tool Co.** in 1916. He was active in the civic and business circles of the community and was a past-president of the **Indiana Manufacturers' Association**.

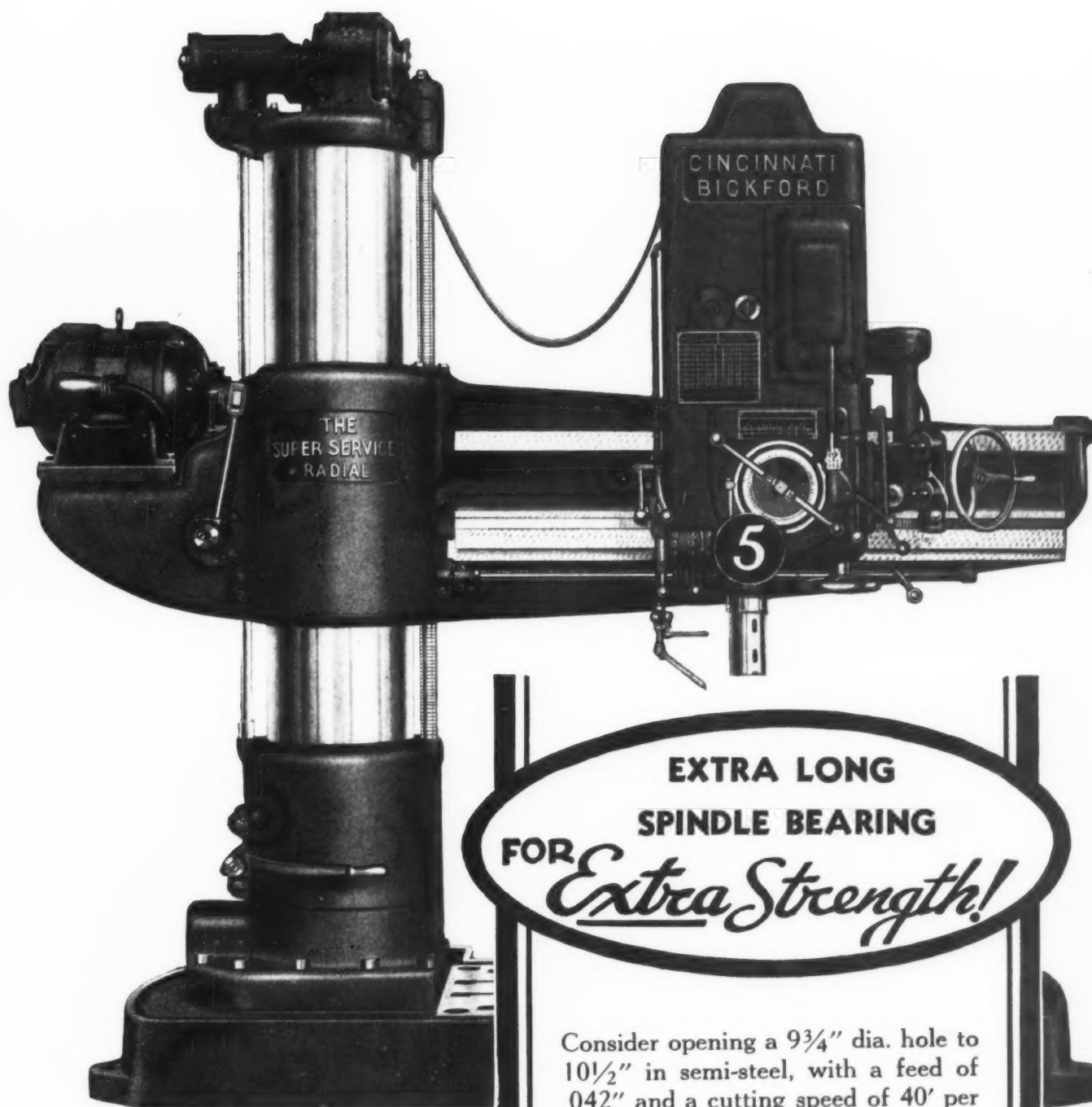
COLONEL CLARENCE R. FALK, secretary and treasurer of the **Falk Corporation**, Milwaukee, Wis., died on September 29, aged sixty-seven years. Mr. Falk was widely known in the manufacturing field. He was born in Milwaukee, Wis. and began his business career in the **First Wisconsin National Bank**. He was then identified with the **Cloos Electrical Engineering Co.**, and in 1901, became associated with the **Falk Corporation**, where he worked his way up through various departments, eventually becoming works manager. In 1914, he was made vice-president, and subsequently became secretary and treasurer.

* * *

Swedenborg—Early Inventor and Engineer

While **Emanuel Swedenborg**, the 250th anniversary of whose birth will be celebrated in January next year, is perhaps best known for his work in the field of religion and psychology, it is of interest to note that his remarkable mind occupied itself with creative work in many varied fields of science and engineering. His reputation is outstanding, not only in the fields of physics, metallurgy, geology, chemistry and physiology, but he was also an inventor and engineer of note in his day.

He edited the first engineering journal to be published in Sweden. Of this journal six numbers appeared during the years 1714-1716; it was issued by a scientific society which later developed into the **Royal Academy of Sciences**. It contains accounts of mathematical and mechanical discoveries and descriptions of **Swedenborg's** own inventions. Among these may be mentioned an air pump actuated by water and depending on the **Toricellian principle**, a flying machine, a coal or mineral conveyor, and a "gun with many barrels." He also made suggestions for a "music machine," an "undersurface ship," and a "mechanical carriage." It is of interest to note that many of the inventions that have become practical only within the past thirty years or so, were conceived of by this prolific mind.



**EXTRA LONG
SPINDLE BEARING
FOR** *Extra Strength!*

**Super-Service
Radial Features**

- ① All Controls Conveniently Low and Centralized
- ② 36 Speeds in Geometrical Progression
- ③ 18 Feed Changes in Geometrical Progression
- ④ Constant Speed Multiple-disc Driving Clutches
- ⑤ **Extra Long Spindle Bearing for Strength and Accuracy**
- ⑥ Herringbone Spindle Driving Gears

The Cincinnati Bickford Tool Company
Oakley, Cincinnati, Ohio, U. S. A.

SUPER-SERVICE RADIALS

Consider opening a $9\frac{3}{4}$ " dia. hole to $10\frac{1}{2}$ " in semi-steel, with a feed of .042" and a cutting speed of 40' per minute. Can you set up your boring tool without a pilot bar or a guide bushing support? You can—on the Super-Service Radial! Because the Spindle on the Super-Service Radial is extra strongly supported. The lower head bearing, through which the spindle sleeve slides, is extra long— $17\frac{1}{2}$ " in length. This bearing is honed to final size, insuring a perfect fit and extra rigid support. The resulting strength and accuracy are unparalleled in Radial Design. This and a dozen other features of equal importance are fully described in the new bulletin R-24. Send for it.

Manual of Gear Design—Third Section

MANUAL OF GEAR DESIGN—SECTION 3. By Earle Buckingham. 172 pages, 8 1/2 by 11 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York. Price, \$2.50.

Section 3 of the "Manual of Gear Design" contains the formulas and tables required in solving all kinds of helical and spiral gear problems. The term "helical gears" has been applied to parallel-shaft drives, and "spiral gears" (in accordance with common usage) to non-parallel non-intersecting shafts.

Section 3 conforms in size and general appearance with the previously issued Sections 1 and 2, Section 1 consisting of mathematical tables for general use in gear design, and Section 2, of formulas and tables for designing spur and internal spur gears.

Section 3, like Section 2, begins with definitions of various gear terms and gives the symbols or notation used in the formulas throughout the book. All formulas are accompanied by examples showing their practical application. Time-saving tables constitute another important feature. These tables eliminate calculations either by giving directly the proportions of various combinations of gears and pinions or by giving partial solutions to many gear problems.

This book not only deals thoroughly with the design of helical and spiral gears, but includes considerable information and data about the cutting of gears. Even change-gear calculation is included, as required in connection with milling or hobbing on a machine with or without a differential mechanism.

The designer who needs at times, in

addition to the ordinary standard formulas, special formulas and data will find this book invaluable. His problem may be to design a transmission having a pinion with a very small number of teeth; or internal helical gears; or planetary drives of the simple or compound type. Possibly there is a question about contact ratio, under-cutting of teeth, interference, end thrust, bearing loads, tooth forms adapted to helical and spiral gears—Section 3 covers these and other important elements of helical and spiral, as well as herringbone gear design.

Information on the standard tooth forms adapted to milled, hobbed, and shaped helical gearing is given, with formulas and examples showing practical application in all cases. The graphical method of determining end thrust and bearing loads is illustrated, and the section on spiral gears features a simple graphical method of especial value when the mathematical solution is indeterminate or must be solved by trial. The sections on power-transmitting capacity deal with dynamic loads, beam strength, and loads limited by wear.

This book is restricted entirely to working information and data, and a complete index enables the user to locate readily any formula or tabulated data required. This latest addition to the "Manual of Gear Design," like its two predecessors, is approved by the American Gear Manufacturers' Association. It represents the accomplishment of a man whose national reputation as a gear-designing expert is based upon the results he has achieved in analyzing and solving gear-designing problems.

Award for High Quality of Advertising

The annual award for high character of trade paper, general magazine, and direct-mail advertising presented by the National Industrial Advertisers' Association has been given this year to the Warner & Swasey Co., Cleveland, Ohio, manufacturer of turret lathes, for the year's outstanding advertising performance.

In making the award, the jury considered simplicity, copy, text, coordination, continuity, typography, lay-out and art work, objective, and results. The Warner & Swasey Co.'s advertising campaign placed emphasis on the production efficiencies attained in specific manufacturing plants throughout industry by means of modern machine tools. H. W. Fortey, director of advertising at the Warner & Swasey Co., has been in charge of the advertising program.

COMING EVENTS

NOVEMBER 17-18—Ninth annual PRODUCTS EXPOSITION of the Purchasing Agents Association of Chicago at the Hotel Sherman, Chicago, Ill. W. J. Auburn, chairman of publicity committee, Hotel Sherman, Chicago, Ill.

NOVEMBER 10-12—Thirty-eighth annual convention of the INTERNATIONAL ACETYLENE ASSOCIATION at the Hotel Tutwiler, Birmingham, Ala. For further information, address International Acetylene Association, 30 E. 42nd St., New York City.

DECEMBER 6-10—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Societies Building, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 6-11—SIXTEENTH EXPOSITION OF THE CHEMICAL INDUSTRIES to be held at Grand Central Palace, New York City, under the direction of Charles F. Roth, Grand Central Palace, New York City.

DECEMBER 8-10—National Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Flint, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 21-25, 1938—WESTERN METAL EXPOSITION AND CONGRESS, in the Pan-Pacific Auditorium, Los Angeles, Calif., under the auspices of the American Society for Metals. W. H. Eisenman, managing director, 7016 Euclid Ave., Cleveland, Ohio.

Objectives of Lincoln Arc-Welding Foundation

Obviously, when such an unusual amount as \$200,000 is offered in prizes for papers on an engineering subject, with the largest prize running well over \$13,000, the question arises: What are the objectives of the organization that is offering these prizes?

In order to answer this question adequately, the James F. Lincoln Arc Welding Foundation has pointed out that the real objective is to make as many men in the engineering and manufacturing fields as possible conscious of the fact that welding offers definite economies in thousands of applications where it is not now being used. The main object is not to obtain a great many papers on welding that can be broadcast through the technical press and otherwise. As a matter of fact, if any one of the contestants requests not to have his paper published, it will not pass beyond the judges.

Instead, the aim of the Foundation is to create sufficient interest in electric welding among people who may not have given it sufficient attention in the past to benefit by its possibilities; to encourage them to study whether welding

could be advantageously used for their particular design and construction problems; and to make them record the results of their study. Manufacturers, for example, may request one of their engineers to study arc welding as applied to the company's own products, to present his findings in the form of a report, and to submit them to the Foundation as a paper in the competition.

Hence, the main object is to make industry as a whole conscious of the economical possibilities of welding.

"Some manufacturers and engineers who are not now using welding," says Mr. Davis, secretary of the Foundation, "will say: 'We do not know anything about welding.' Actually, that is the very reason for offering the awards. It will induce engineers and mechanical men generally to study the subject, so that they may know something about it. Another man will say: 'I am not much of a writer and I could not prepare a paper.' To him I would answer: 'We do not want masters of English to prepare papers; we want engineers, anxious to study the possibilities of a new art.'"

Air-Conditioning—A Fast Growing Industry

Air-conditioning has become the basis of an important industry in the United States in a very few years. At the end of 1936, according to a survey just completed by the Marketing Research Division of the Department of Commerce, there were fourteen times as many air-conditioning installations in this country as at the beginning of 1933. Approximately 265,000 horsepower of motive energy was required to operate them.

Aside from the work and the various materials required to build and install this air-conditioning equipment, there was involved in its operation the consumption of large volumes of water. If the installation of air-conditioning equipment continues to increase, according to the *Compressed Air Magazine*—and there is every reason to expect that it will—heavy investments in water works equipment will be required, because a considerably larger volume of water is required in establishments and homes with air-conditioning equipment.

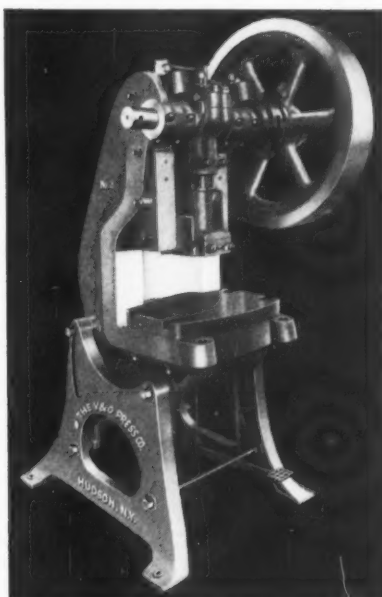
Those not directly engaged in the air-conditioning industry do not realize how extensively such equipment is used in this country. Many industries depend on it to provide the proper atmospheric conditions for the manufacture, processing, handling, and packaging of manifold foodstuffs and commodities, and controlled weather is contributing much to the comfort and well-being of workers in offices and factories. Hotels, theaters, and stores are well-known users of air-conditioning systems, but they by no means account for all the air-conditioning equipment being built.

* * *

An unusual evidence of the profound effect that the automobile has had on road building throughout the world recently came to our attention. A book entitled "Australasian Roads," published by Robertson & Mullens, Ltd., Melbourne, Australia, containing over 800 large-sized pages, describes in detail the building of different types of roads in that part of the world, giving unusually complete engineering information—as complete, we believe, as any similar book published in the United States. Automobiles and roads obviously go together!

Presses Painted for Safety and Visibility

Inclinable presses built by the V & O Press Co., Hudson, N. Y., are now being painted white across the throat of the frame and in between



Inclinable Press Painted White across the Throat and between the Housings

the housings. This feature provides clearer visibility for the operator, thereby reducing eye-strain and accidents and promoting efficiency.

* * *

Graton & Knight Operates Laboratory on Wheels

The Graton & Knight Co., Worcester, Mass., manufacturer of leather belting and other leather products, has recently equipped a traveling laboratory which will visit various industrial centers. In this laboratory, it is planned to duplicate the



Graton & Knight Traveling Laboratory

power transmission problems of manufacturers who are actual or potential users of leather belting, and to show how power transmission problems can be solved. The laboratory includes a 40-horsepower power plant, and is fully equipped with instruments to perform accurately the various tests required. In this traveling laboratory, it is possible to test all types of flat belts and to determine the efficiency of each. The traveling laboratory is 35 feet long, 9 feet high, and 7 feet wide. It weighs 20,000 pounds.

* * *

British Specifications for Direction of Rotation of Handwheels

The British Standards Institution, 28 Victoria St., London, S.W. 1, England, has recently issued a specification designated No. 754-1937, which defines the direction of rotation of machine tool handwheels and levers relative to the movement of the machine elements to be actuated. When screw-operated machine members are concerned, clockwise rotation of the crank or handwheel, in general, moves the machine member affected toward the cutting position. In rack-and-pinion mechanisms, the general rule is that the part of the crank or handwheel normally gripped by the operator should move in the same direction as the member of the machine affected. The publication covers operating devices for lathes and drilling, milling, planing, slotting, shaping, and grinding machines.

* * *

Special Training in Technical Writing

With the view of aiding technical men in writing for publication clearly and effectively, the Extension Division of the University of Wisconsin, Madison, Wis., is offering home study courses in the composition of technical papers and articles, available to engineers and technical men all over the country. Through such correspondence study it is possible to acquire training in writing technical business letters, reports, and articles for publication without interruption of the student's daily occupation. Such training is of great value to any engineer or technical man, as it increases his effectiveness.

**Continued
Popularity
---on All types
of Grinding**

**4 sizes of
UNIVERSALS**

**Flexible
Simple
Readily Set-Up
Easily Operated**

- for Production**
- for the Toolroom**
- for General Grinding**

Ask for specifications.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.



BROWN &



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SHARPE

NEWS OF THE INDUSTRY

California

HANSON-VAN WINKLE-MUNNING Co., Matawan, N. J., has appointed the CHAMBERLAIN Co., INC., 2550 E. Olympic Blvd., Los Angeles, Calif., distributor for the company's products in southern California. The Chamberlain Co. is carrying a complete stock of supplies for the plating industry. JACK D. CLAYTON, formerly representing the Hanson-Van Winkle-Munning Co. in Detroit, is acting as sales representative for the Chamberlain Co., Plating Supplies Division, in southern California.

Illinois

ARTHUR T. COX, JR., has been appointed manager of the Tri-Cities welding sales-engineering office of the Lincoln Electric Co. at 1205-09 Fourth Ave., Moline, Ill. Mr. Cox succeeds J. B. FLOCK, who is taking a year's leave of absence.

LOUIS A. ALMGREN, formerly chief tool designer of the Service Tool, Die & Mfg. Co., Chicago, Ill., has joined the Tool Equipment Sales Co., 4625 Fulton St., Chicago, Ill., in the capacity of sales engineer.

C. F. PEASE Co., Chicago, Ill., manufacturer of blueprinting machines, blueprint paper, drafting-room furniture, etc., has recently moved into its new plant at 2601 W. Irving Park Road.

Michigan

HUTTO MACHINE DIVISION OF THE CARBORUNDUM Co., 515 Lycaste Ave., Detroit, Mich., has sold its assets and good will to the MICROMATIC HONE CORPORATION, 7401 Dubois at Horton, Detroit, and the BARNES DRILL Co., Rockford, Ill. The Barnes Drill Co. will absorb that part of the business relating to the manufacture, sale, and service of honing machines and gear lapping machines. The Micromatic Hone Corporation will take over the manufacture, sale, and service of honing tools and tool replacement parts. The latter company will also carry a full line and render a full replacement service of Carborundum brand cylinder honing stones, as well as other lines of abrasive honing sticks. KIRKE W. CONNOR will serve as chief executive of the combined organizations relating to honing tool manufacture. HARRY M. WHITTAKER, formerly chief

engineer with the Micromatic Hone Corporation, has been appointed vice-president and director of sales; and J. E. KLINE, formerly chief engineer of the Hutto Tool Division, becomes chief engineer of the combined organizations.

ESCO ENGINEERING SERVICE Co., 3120 Monroe St., Toledo, Ohio, manufacturer of jigs and tools, has sold its business to the REGAL ENGINE Co., of Coldwater, Mich. The new company will be known as the REGAL MFG. Co., and all manufacturing will be done at the Coldwater plant. The Esco Engineering Service Co. will retain its identity as a division of the Regal Mfg. Co., with sales and engineering offices at 1010 Beaubien St., Detroit. The new officers of the company are: President, W. J. CARLISLE; vice-president and secretary, ROBERT W. ALLEN; vice-president in charge of sales, FRANCIS J. MCGARRY; vice-president and chief engineer, FREDERICK M. ROSS.

H. W. BOULTON, of the Murray Corporation of America, Detroit, Mich., has been elected general chairman of the Automotive and Machine Shop Section of the National Safety Council, Inc., which has headquarters at 20 N. Wacker Drive, Chicago, Ill. L. B. LOOMIS, of the Ternstedt Manufacturing Division of the General Motors Corporation, Detroit, Mich., has been elected vice-chairman, and C. W. BISHOP, of the Lycoming Mfg. Co., Williamsport, Pa., secretary.

ACHESON COLLOIDS CORPORATION, Port Huron, Mich., has issued a statement to the trade pointing out that the word "dag," as well as the words "Oildag," "Aquadag," "Glydag," "Castordag," "Varnodag," and "Prodag" are trade names and not generic terms. These trade names represent brands of colloidal products in various mediums, and are protected by the trademark laws.

HAMMOND MACHINERY BUILDERS, Kalamazoo, Mich., announce the appointment of W. J. Bach, 1400 Tenth Place, S., Birmingham, Ala., as their representative in the sale of grinders for foundry use. Mr. Bach will cover the states of Tennessee, Georgia, Alabama, Florida, Louisiana, North Carolina, and South Carolina.

DETROIT REX PRODUCTS Co., 13005 Hillview Ave., Detroit, Mich., manufacturer of degreasing machines and solvents, has completed the construction of a large manufacturing building which will provide 30,000 square feet of additional floor space.

PARKER RUST-PROOF Co., East Milwaukee Ave., Detroit, Mich., is constructing a new building to provide additional

office and laboratory facilities. The new addition to the plant will be a two-story fireproof structure, and will make available twice the present office and laboratory space.

ATLAS PRESS Co., Kalamazoo, Mich., recently completed a plant addition which provides 15,000 square feet of additional floor space. The new floors are being used to increase production of the company's bench lathes, shapers, drill presses, and arbor presses.

New Jersey

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J., was awarded honorable mention for the company's industrial trade journal advertising at the recent annual convention of the National Industrial Advertisers Association in Chicago.

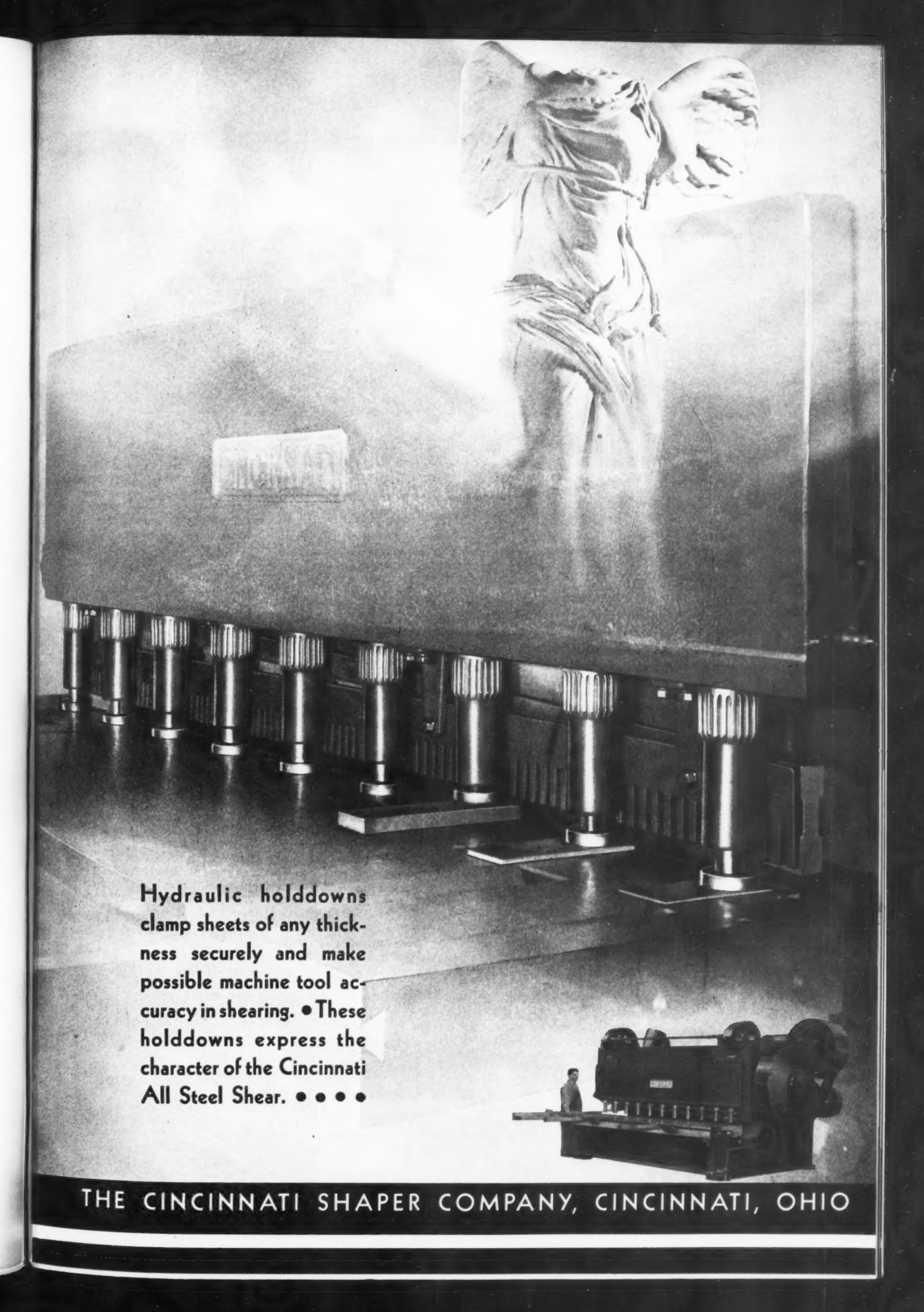
New York

H. SIDNEY SMITH, consulting engineer of the Union Carbide Co., New York City, was awarded the James Turner Morehead medal for the year 1936 at



H. Sidney Smith, Who was Recently Awarded the James Turner Morehead Medal

the annual convention of the International Acetylene Association held at the Tutwiler Hotel, Birmingham, Ala., early in November. This medal is awarded annually by the International Acetylene Association to the person who, in the judgment of the officers and board of directors, has done most to advance the industry or the art of producing or utilizing calcium carbide or its derivatives. The medal was awarded to Mr. Smith for "his vision, inspirational guidance, and aggressive cooperation in the advancement of the acetylene industry."



Hydraulic holddowns clamp sheets of any thickness securely and make possible machine tool accuracy in shearing. • These holddowns express the character of the Cincinnati All Steel Shear. • • • •

THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

DR. PAUL DYER MERICA, director of research of the International Nickel Co., New York City, and vice-president of the International Nickel Co. of Canada, has been awarded the 1938 John Fritz gold medal for "important contributions to the development of alloys for industrial uses." This award is made annually for notable scientific or industrial achievement by a board composed of representatives of the four national engineering societies of civil, mining and metallurgical, mechanical, and electrical engineers.

A. T. HATCH, of the Davenport Machine Tool Co., Inc., 167 Ames St., Rochester, N. Y., has been appointed president and general manager of the company, to succeed the late Mr. Davenport. Mr. Hatch was previously secretary-treasurer and assistant to Mr. Davenport in the management of the business. R. M. WHITNEY, formerly auditor, succeeds Mr. Hatch as secretary-treasurer.

CARL ZEISS, INC., 485 Fifth Ave., New York City, announces that hereafter the distribution and servicing of Zeiss industrial measuring instruments will be handled directly by the firm from the New York office. Many of the instruments will be on display in the showrooms, and experts will be available to give advice on measurement and inspection problems.

PROFESSOR S. C. HOLLISTER, of Cornell University, Ithaca, N. Y., has been appointed dean of the College of Engineering, succeeding the late Herman Diedrichs, who died last summer. Professor Hollister, who went to Cornell in 1934 from Purdue University, has been associate dean of the College of Engineering and director of the School of Civil Engineering of Cornell University.

J. S. VANICK, a member of the development and research division of the International Nickel Co., Inc., 67 Wall St., New York City, recently addressed the Rochester Chapter of the American Society for Metals on various applications of alloyed cast iron.

CARL M. SNYDER has been appointed manager of appliance sales for the General Electric Co., Schenectady, N. Y.

Ohio

DETROIT REX PRODUCTS Co., 13005 Hillview Ave., Detroit, Mich., manufacturer of degreasing machines and solvents, has opened a branch office in the Provident Bank Bldg. at Cincinnati, Ohio.

LOUIS POOCK, vice-president and general manager of the Sheffield Gage Corporation and the Cimatool Co., of Dayton, Ohio, has been made chairman of the Dayton-Columbus-Cincinnati section



Louis Poock, New Chairman of the Dayton-Columbus-Cincinnati Section of the SAE



David M. Harvey, Superintendent of the Oil Department of E. F. Houghton & Co.

of the Society of Automotive Engineers. W. W. TANGEMAN, vice-president of the Cincinnati Milling Machine and Cincinnati Grinders, Inc., and K. W. STINSON, professor of automotive engineering at Ohio State University, Columbus, Ohio, have been made vice-chairmen.

FRANK FIELDS has been appointed general manager of the Sidney Machine Tool Co., Highland Ave., Sidney, Ohio, succeeding A. C. GETZ, who now assumes the duties of vice-president.

E. S. BOSTON has been appointed district sales manager of the Patterson Foundry & Machine Co., East Liverpool, Ohio, with headquarters at St. Louis, Mo.

Pennsylvania

ROBERT H. SCHUSTER has joined the sales staff of the Pittsburgh office of the Lincoln Electric Co., located at 926 Manchester Blvd., N.S., Pittsburgh, Pa. Mr. Schuster has been employed in sales work in the Pittsburgh district with the Ault & Wilborg Division of the Inter-Chemical Corporation for the last five years. He will work under the direction of W. R. Persons, who was recently appointed district manager of the Pittsburgh office.

WRIGHT & GADE EQUIPMENT Co., 3701 N. Broad St., Philadelphia, Pa., has been appointed representative for the complete line of flexible shaft equipment and tapping machines made by the R. G. HASKINS Co., 4636 W. Fulton St., Chicago, Ill.

DAVID MAITLAND HARVEY has been appointed superintendent of the oil department of E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa., manu-

facturer of metal cleaners, processing oils, heat-treating salts, lubricants, and leathers. Prior to his present appointment, Mr. Harvey spent six years at the Houghton plant in Manchester, England. His experience includes more than twenty years as superintendent of production for several large oil and chemical manufacturers.

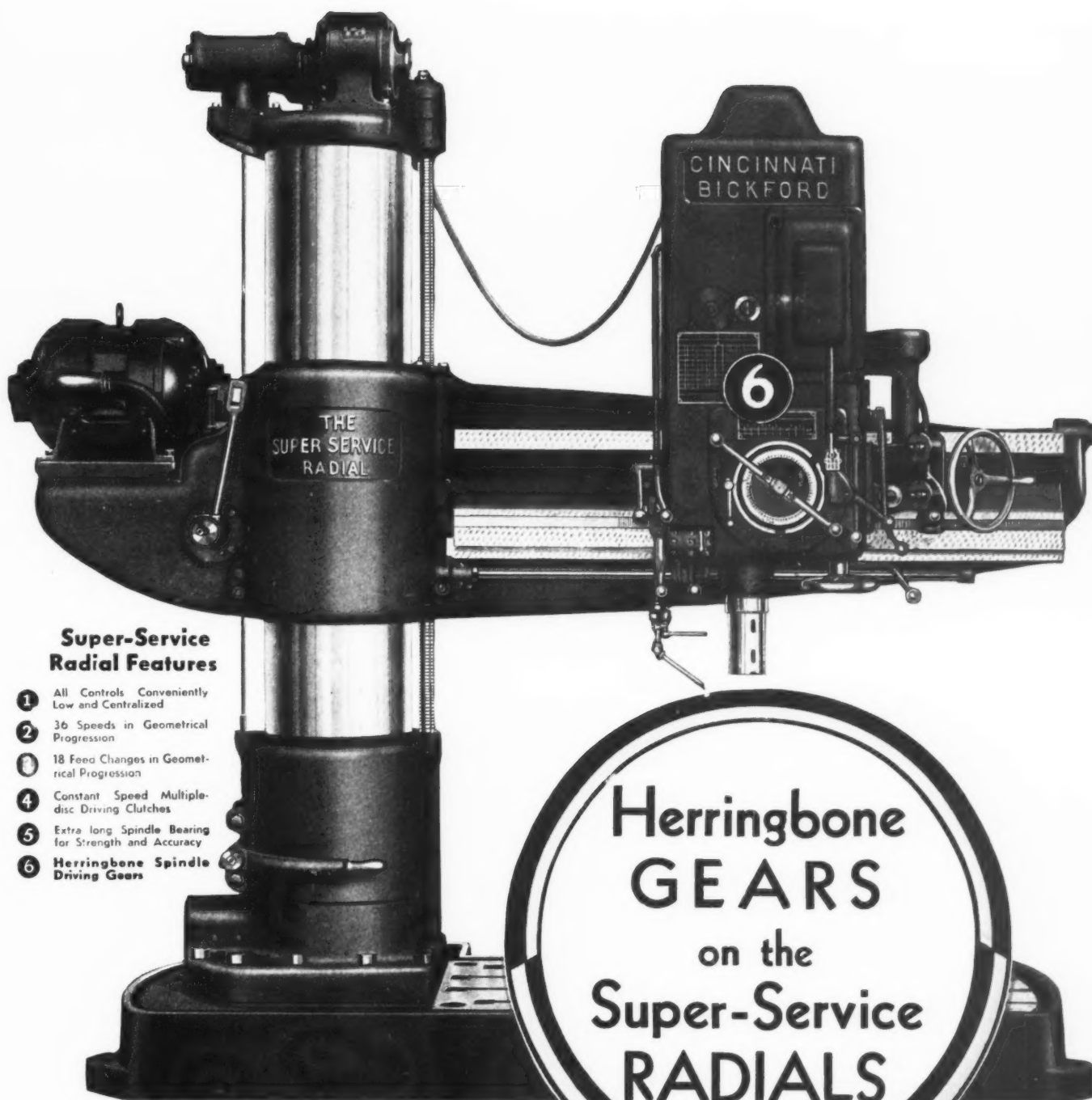
J. M. MCNEAL, European sales manager of the Landis Machine Co., Inc., Waynesboro, Pa., has returned to the home office for a visit. Mr. McNeal looks after the company's interests in England and on the Continent. His headquarters are at Birmingham, England.

Wisconsin and Minnesota

R. L. JOHNSTONE, 1407 N. Hanley Road, St. Louis, Mo., has been appointed representative of Graham Transmissions, Milwaukee, Wis., manufacturers of the Graham variable-speed transmission. Other new representatives appointed are CHAS. C. GRANT, 436 Second National Bldg., Akron, Ohio, and GEORGE P. COULTER, 322 Curtis Bldg., Detroit, Mich.

DUMORE Co., Racine, Wis., manufacturer of electric motors and tools, has erected a \$10,000 addition to its factory. The new fireproof, air-conditioned building contains 640 square feet, and consists of two rooms for the spraying and baking of paint.

CONTINENTAL MACHINE SPECIALTIES, INC., 1301 Washington Ave., S., Minneapolis, Minn., has announced a prize contest with a first prize of \$100 and a second prize of \$50, together with several additional prizes, for information relating to unusual accomplishments obtained through the use of the com-



Super-Service Radial Features

- ① All Controls Conveniently Low and Centralized
- ② 36 Speeds in Geometrical Progression
- ③ 18 Feed Changes in Geometrical Progression
- ④ Constant Speed Multiple-disc Driving Clutches
- ⑤ Extra long Spindle Bearing for Strength and Accuracy
- ⑥ Herringbone Spindle Driving Gears

For gears running on parallel shafts, continuous tooth Herringbone Gears are the smoothest—and strongest—practical gears known to engineering science. That's why they are used for the Final Spindle Drive on the Super-Service Radial. That's why large boring, facing and trepanning on the Super-Service Radials are always s-m-o-o-t-h running operations. The Super-Service Radials are the only radials equipped with continuous tooth Herringbone Gears—with a guarantee of at least 60% more strength. Many other interesting features are described in bulletin R-24. Send for it.

**Herringbone
GEARS**
on the
**Super-Service
RADIALS**

THE
CINCINNATI BICKFORD
TOOL COMPANY
Oakley, Cincinnati, Ohio, U.S.A.

pany's "Doall" machine for contour sawing and filing. Those interested can obtain further information relating to the contest and the rules governing it, by communicating with the company directly.

COMING EVENTS

DECEMBER 6-10—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in the Engineering Societies Building, New York City. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 6-11—SIXTEENTH EXPOSITION OF THE CHEMICAL INDUSTRIES to be held at Grand Central Palace, New York City, under the direction of Charles F. Roth, Grand Central Palace, New York City.

DECEMBER 8-10—National Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Flint, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 21-25, 1938—WESTERN METAL EXPOSITION AND CONGRESS, in the Pan-Pacific Auditorium, Los Angeles, Calif., under the auspices of the American Society for Metals. W. H. Eisenman, managing director, 7016 Euclid Ave., Cleveland, Ohio.

MARCH 23-25—National spring meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Los Angeles, Calif. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 4-6—Machine Shop Practice meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Rochester, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 14-19—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago, Ill.

JUNE 20-24—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OBITUARIES

William Collins Buell

William Collins Buell, vice-president and secretary of the Diamond Machine Co. and assistant treasurer of the Builders Iron Foundry, Providence, R. I., died at sea while on his way to California, on October 21. He was born in Troy, N. Y., nearly eighty-one years ago, and was a direct descendent of William Buell, who came from Huntingdonshire, England, to Dorchester, Mass., in 1630.

After graduating from the Troy Academy at the age of fifteen, Mr. Buell entered the employ of J. M. Warren & Co., hardware merchants in Troy. In 1889, he moved to Providence and be-



© Bachrach

William C. Buell

came treasurer of the Diamond Machine Co., which position he held until 1894, when the Diamond Machine Co. became affiliated with the Builders Iron Foundry. Thereafter, except for a brief period, Mr. Buell's official positions until the time of his death were those of vice-president and secretary of the Diamond Machine Co. and assistant treasurer of the Builders Iron Foundry.

For some years prior to his death, he was relatively inactive in the business, but was still identified with it as a consultant and carried on a share of the routine work. While he was especially associated with the development of grinding machinery, he had a share in the development of many special machines, and particularly during the war, was engaged in the production of machines for drilling, reaming, and rifling gun barrels for the American and foreign governments.

Mr. Buell had an unusual capacity for making friends, as well as an exceptional capacity for work. He was scrupulously accurate in all details, and had

a keen sense of obligation in meeting the wishes and needs of his customers. The following quotation from a letter received after his death is typical: "Buell was a good friend of mine for forty years. When you can do business with a man for forty years without a dispute of any kind, 'it is something'."

Mr. Buell had many interests apart from his business. He was fond of fishing, hunting, baseball and golf. He was much interested in gardening, and each morning during the season, would bring flowers to the office for the members of the office force. He never spoke ill of anyone and it is doubtful if he ever made an enemy during his sixty-six years of business life. He leaves a wider circle of friends than it is the privilege of most men to have made.

In 1881, Mr. Buell was married to Miss Sarah Covell Hagan, who died in June 1900. In 1912, he married Mrs. Emma Reeseman Main. He is survived by his wife, a son, William Collins Buell, a daughter, Lydia Hagan (Buell) Carter, and six grandchildren.

Percy C. Brooks

Percy C. Brooks, formerly executive vice-president of Fairbanks, Morse & Co., Chicago, Ill., died at his home in Chicago on October 15, after an illness of about a year, at the age of sixty-five.

Mr. Brooks started his business career with the Atlanta Machine Works, following his graduation from the Georgia School of Technology in 1891. In 1898, he began nearly forty years of association with Fairbanks, Morse & Co., starting as assistant to the general manager at Beloit, Wis. His attention to details and keen power of analysis won him prompt and continuous advancement. He became manager of the Beloit plant, and when the Canadian Fairbanks-Morse was organized and a factory was built in Toronto in 1905, he was appointed general manager. Four years later he was made vice-president of the Canadian enterprise.

At the outbreak of the war in 1914, Mr. Brooks, converted his factory into a munitions works for the British Government. After the war, he was transferred to St. Johnsbury, Vt., as vice-president of the E. & T. Fairbanks Co., of which he later became president, holding that position for about ten years. He was also president of E. & T. Fairbanks & Co., Ltd., of Canada and had supervision of the company's plant at East Moline, Ill. In 1930, he was transferred to Chicago as executive vice-president, which position he relinquished a few months before his death.

THOMAS G. LAMANNA, district sales manager for the Gisholt Machine Co., Madison, Wis., with headquarters at Indianapolis, was killed on November 8, when a fast train struck his automobile on a crossing a few miles southeast of Anderson, Ind. Mr. LaManna had been associated with the Gisholt Machine Co.

Better than they need be



... that's what buyers say when they examine the new Parker-Kalon Cold-forged Socket Screws. These new Screws have set a higher standard of quality that wins the unqualified approval of engineers and production men.

There are good reasons for the excellence of these new Screws. They are the result of more than two years of intensive research and development work ... and the unequalled Parker-Kalon Laboratory facilities for securing and controlling the strength, precision and other essential qualities of socket screws.

Send for free samples of the type you use, and descriptive folder. The product will speak for itself.

PARKER-KALON CORPORATION,

202 Varick Street, New York

BETTER
than they need be
in every essential

- ✓ Engineered **STRENGTH**
- ✓ Controlled **UNIFORMITY**
- ✓ Micrometer **ACCURACY**
- ✓ Faultless **DESIGN**

PARKER-KALON
Cold-forged

SOCKET SCREWS

since 1928 as sales representative, first in St. Louis, later in Chicago and, during 1937, in Indianapolis. He was a graduate of Columbia University in mechanical engineering, and served both with the Aviation Commission and the Italian Commission during the World War. He was forty-two years old.

JOHN A. SCHLEICHER, for several years associated with the Brown & Sharpe Mfg. Co., Providence, R. I., died recently in his seventy-seventh year. Mr. Schleicher entered the employ of Brown & Sharpe on June 3, 1887 and, with the exception of an intermission in 1893, remained with the company until May, 1905. While with the company he became an expert on formed tool work, and was ultimately made designer of tools and manufacturing methods. For a short time, in 1893, he was connected with Gay & Ward at Athol, Mass., helping to equip and organize the factory which later became the Union Twist Drill Co.

After leaving the Brown & Sharpe organization he was connected with the following concerns in various capacities: Metropolitan Sewing Machine Co., Nyack, N. Y.; Sutherland Rifle Sight Co., New Glasgow, N. S.; Wales Adding Machine Co., Wilkes Barre, Pa.; Hopkins & Allens Arms Co., Norwich, Conn.; and the Lufkin Rule Co., Saginaw, Mich.

ELIHU R. LYMAN, president of the Massachusetts Gear & Tool Co., Woburn, Mass., died at his home in that city October 29, at the age of fifty-six years. Mr. Lyman was a graduate of the Worces-

ter Polytechnic Institute. His earlier years were spent successively with the Buffalo Forge Co., the United States Radiator Corporation, and the Dexter Folder Co. In 1922, associated with Joseph Cavvicchi, he formed the Massachusetts Gear & Tool Co. of which he was president and treasurer until his death. He was a member of the National Metal Trades Association and the American Gear Manufacturers' Association.

HERBERT CHARLES BALLORD, for the last eight years branch manager of the Baltimore office of the Crucible Steel Co. of America, died in Baltimore on October 22 at the age of fifty-eight. Mr. Ballord was born in Ashford, Kent Co., England, and came to the United States with his parents as a child, the family settling in Syracuse, N. Y. He had been connected with the Crucible Steel Co. of America for thirty years, and was widely known among business men in New York State and in the South. He was a member of the American Society for Metals and served as chairman of the Baltimore branch of the society.

I. H. BARBEE, manager of the Atlanta plant of the Link-Belt Co., died on November 4 in a Philadelphia hospital, which he entered about six weeks ago while on vacation. Mr. Barbee, a mechanical engineering graduate of Purdue University, class of 1908, was born in Tennessee, where he received his early education. He had a wide engineering experience, and served the Link-Belt Co. at its Chicago, Philadelphia, and Atlanta plants for about twenty-five years.

the Stop-Watch Study; Determining Rating Factor, Allowances, and Time Standard; Determining Time Standards from Elemental Time Data and Formulas; The Use of Elemental Time Data and Formulas—Two Cases: Gear Hobbing and Soldering Cans; Determining Time Standards for Die and Tool Work; and Training the Operator.

MECHANICAL CATALOG (1937-1938). 395 pages, 8 1/2 by 11 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the twenty-seventh annual edition of a comprehensive catalogue of industrial equipment, materials, and supplies. Its contents consist of essential specification-type data on more than 1600 items, thoroughly indexed and cross-indexed. In connection with the catalogue data, the main offices, branch offices, trade names, agents, detailed descriptions of products, and manufacturers' bulletin numbers are given.

Besides the catalogue material, the book contains a classified index to manufacturers, containing the names and addresses of more than 850 manufacturers of industrial equipment, listed under 4800 classifications of equipment. This index should prove of great value in locating the source of equipment needed by engineers. It contains not only the names of manufacturers whose products are catalogued, but a great number of additional concerns in the mechanical engineering field. The third section of the book contains a complete alphabetical list of the manufacturers, with their addresses, whose products are indexed.

MAC RAE'S BLUE BOOK (1937-1938). 3370 pages, 8 1/2 by 11 inches. Published by MacRae's Blue Book Co., 51 Madison Ave., New York City. Price, \$15.

This is the 45th edition of a comprehensive commercial register covering all manufactured products in the United States. The present edition follows the same arrangement as the previous ones, the first section containing an alphabetical list of manufacturers, producers, and wholesalers, including in many cases the addresses of branch offices. The second section contains an index of products, or finding list. The third or main part of the book is the classified material section, which contains a list of the manufacturers classified according to their products. The trade facilities section follows, listing the towns having a present estimated population of 1000 or more, and gives the leading commercial body with the name of the secretary, the leading bank and the name of the cashier, names of all railroads, and the names of storage and distributing warehouses. Airports and flying fields are also indicated. All the sections of the book are printed on different colored paper for ready reference. This directory will be found an invaluable aid in locating sources of supply and compiling mailing lists.

NEW BOOKS AND PUBLICATIONS

LEARNING TO READ MECHANICAL DRAWINGS. By Roy A. Bartholomew and F. S. Orr. 48 pages, 8 1/2 by 11 inches. Published by the Manual Arts Press, Peoria, Ill. Price, 40 cents.

This is a paper-bound book containing instructions for beginners in reading mechanical drawings. The lessons are planned so that the student can learn easily and quickly the fundamentals of mechanical drawing. Practice is provided in lettering and sketching, as well as in reading drawings. The book is intended to be used by teachers in connection with class work. It is best suited for junior high-school work, but can be used by older pupils in a very short course.

MOTION AND TIME STUDY. By Ralph M. Barnes. 285 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, \$3.75.

The present trend toward increased

efficiency in all kinds of work has brought about a widespread interest in motion and time study. This book offers a thorough analysis of the subject. An idea of the treatment can be obtained from the following list of chapter headings:

Definition and Scope of Motion and Time Study; History of Motion and Time Study; Extent to which Motion and Time Study may be Profitably Used; Process and Operation Analysis; The Use of Micromotion Study; Definition of Therbligs; Micromotion Study Equipment; Making the Motion Pictures; Film Analysis; The Use of the Therbligs; Fatigue; Principles of Motion Economy as Related to the Use of the Human Body; Principles of Motion Economy as Related to the Work Place; Principles of Motion Economy as Related to the Design of Tools and Equipment; Standardization—Written Standard Practice; The Relation of Time Standards to Wage Incentives; Making



Phil Huber, New President and General Manager of the Ex-Cell-O Corporation

WOODWORTH, who resigned because of ill health. H. G. BIXBY, assistant secretary since 1929 and controller since 1932, was elected secretary, treasurer, and a director. Mr. Huber has been successively chief inspector, factory superintendent, vice-president, and assistant general manager. He has been responsible for the major machine tool and equipment developments of the company, notably the precision boring machine and thread grinder.

LINCOLN PARK TOOL & GAGE Co., Lincoln Park, Mich., announces that it is now operating a department devoted exclusively to hard chrome-plating which has been installed in a new addition to the plant. The new plating department, which is operated under the license and engineering service provided by the United Chromium Co., will be equipped to plate work ranging from a 1/16-inch diameter hole to a bar 5 feet long.

DELUXE DIE WORKS, Detroit, Mich., have recently built a new shop at 18800 Hawthorne Ave., Detroit, Mich., which is twice as large as the old one, to take care of their expanding business.

GEORGE E. GUSTAFSON was recently appointed works manager of the Kearney & Trecker Corporation, Milwaukee, Wis. Mr. Gustafson has been with the company in various capacities for over fifteen years. EDGAR W. TRECKER has been appointed sales manager. RALPH W. BURK, who has been directly and indirectly identified with the sale of Kearney & Trecker products for over twenty years, has been appointed general sales manager.

MODERN COLLET & MACHINE Co., Ecorse, Mich., announces that WARD H. RICE, formerly a buyer for the International Harvester Co., is now sales representa-

tive for the company in the state of Wisconsin. Mr. Rice's offices are located at 437 Commerce Bldg., Milwaukee.

New Jersey

AMERICAN SAW MILL MACHINERY Co., Hackettstown, N. J., manufacturer of "American" saw mill equipment and "Monarch" woodworking machinery, has elected the following new officers: President, ROGER D. PROSSER, who for many years has been secretary of the company; vice-president and treasurer, WILLIAM E. GUILD, formerly general sales manager; vice-president in charge of sales and secretary, WALTER D. BRIGGS, formerly assistant sales manager. MALLORY L. FLETCHER, who has been connected with the company for thirty-three years, and who for many years has been vice-president and treasurer, has retired from active service, but remains a member of the board of directors. The general sales offices of the company in New York City have been moved to larger quarters at 120 Wall St.

HANSON-VAN WINKLE-MUNNING Co., Matawan, N. J., manufacturer of electroplating equipment and supplies, has considerably enlarged its plant facilities due to the pressure of increased business. An additional office building has been erected, which will be used for drafting and engineering purposes. Another extension has been made to the electrical shop, adding a total of 6000 square feet of space.

W. E. WECHTER has been appointed manager of oil and gas engine sales, Atlantic Division, of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Wechter succeeds R. L. HOWES, who recently resigned.

New York

HIGH SPEED HAMMER Co., Inc., 313 Norton St., Rochester, N. Y., announces the appointment of the following concerns as exclusive sales representatives for High Speed precision drilling machines: H. A. SMITH MACHINERY Co., Erie Blvd., East and S. Townsend St., Syracuse, N. Y., in the eastern part of up-state New York. W. S. GALLAGHER, 1807 Elmwood Ave., Buffalo, N. Y., in that part of New York State lying west of Rochester, including Erie Co., Pa. WILLIAM HALPERN & Co., 53 Park Place, New York City, in the states of Massachusetts, Rhode Island, and Connecticut; this concern will cover three counties in Connecticut and metropolitan New York jointly with H. M. STARKE, 33 Weston St., Nutley, N. J. The concern also announces the appointment of DOWDING & DOLL, LTD., Greycoat St., Westminster, London, S.W. 1,

England, as exclusive representative for the full line of High Speed riveting hammers and tools for the British Isles. Dowding & Doll, Ltd., will also sell the High Speed precision drilling machine, Model R-53.

CHARLES N. MASON, president of the Electrical Securities Corporation and the General Electric Employees' Securities Corporation, has just completed fifty years with the General Electric Co. On November 1, 1887, as a boy of seventeen, he entered the employ of the Boston office of the Thomson-Houston Electric Co., which was consolidated with the Edison General Electric Co. in 1892, and later became the General Electric Co. Mr. Mason is one of three living men who have completed fifty years of service with the General Electric organization.

CHARLES W. RAUCH has been appointed advertising manager of the Marlin-Rockwell Corporation, Jamestown, N. Y., manufacturer of ball bearings, succeeding the late A. A. McGowen. Mr. Rauch has been connected with the company for twenty years, the last ten of which he has been manager of the technical publications department. That department and the advertising department are now combined under one head. For the first ten years he served in the engineering department in the successive capacities of designer, chief draftsman, sales engineer, and consulting engineer.

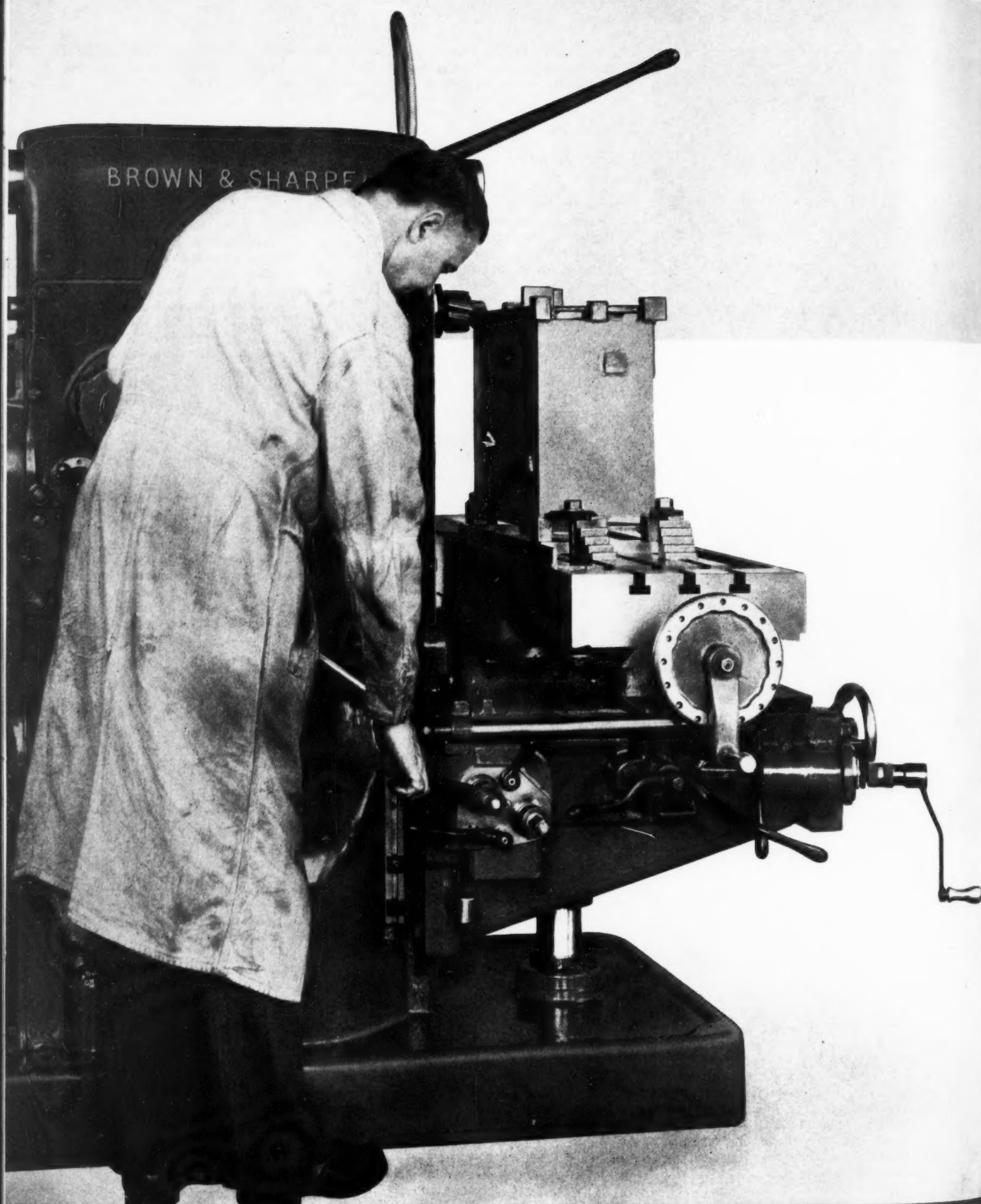
CLARENCE A. VOLKMAN and THOMAS L. PINKNEY have been added to the sales organization of the Ozalid Corporation, 354 Fourth Ave., New York City. Mr. Pinkney, who was formerly with the Eugene Dietzgen Co., of New York, will represent the company in the southwest. Mr. Volkman, who until recently represented the Charles Bruning Co., of New York, will become a member of the Chicago sales staff of the company.

THOMAS PROSSER & SON, importers, engineers, and dealers in fine steel, mechanical specialties, and machinery, and American representatives since 1851 of the Krupp Steel Works of Germany, announce that after ninety-two years in the same building at 15 Gold St., they have moved to larger and more modern offices at 120 Wall St., New York City.

CHARLES E. WILSON, of Bridgeport, Conn., vice-president in charge of the General Electric Co.'s appliance and merchandise department since 1930, has been elected executive vice-president. PHILIP D. REED has been elected assistant to the president.

Ohio

JOHN HELLSTROM, vice-president of the American Air Filter Co., Louisville, Ky., has been elected chairman of the



BROWN &

— *Every Feature*
for PROFITABLE PRODUCTION
on the **DUAL CONTROL TYPE**

- ✓ **All Controls** — power and hand
— at both **Front** and **Rear**
- ✓ **High speed range**
- ✓ **Wide feed range**

Available in Nos. 2 and 3 Sizes . . .
both Universal and Plain. May
we send specifications of these
modern milling machines?

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

Handy Controls at
rear **save time** on jobs
like illustration.



SHARPE

Dust Control Equipment Association, having headquarters at Penton Bldg., Cleveland, Ohio. S. S. PARSONS, of the Parsons Engineering Corporation, Cleveland, Ohio, has been elected vice-chairman. ARTHUR J. TUSCANY continues to hold the position of executive secretary and treasurer.

LINCOLN ELECTRIC Co., Cleveland, Ohio, manufacturer of arc-welding equipment, announces the opening of a welding sales-engineering office at 412 Title Bldg., Atlanta, Ga. The office will be under the management of ROBERT DANIELS, and will offer free consultation service on any problem relative to the use of welding.

F. J. ELLIOTT has recently been appointed Cleveland district sales manager of the Rustless Iron and Steel Corporation, Baltimore, Md., with sales office at 731 Society for Savings Bldg., 145 Public Square, Cleveland, Ohio. Mr. Elliott was formerly associated with E. F. Houghton & Co., of Philadelphia, Pa.

OBITUARIES

JOHN GOULD JENNINGS, chairman of the board of the Lamson & Sessions Co., Cleveland, Ohio, died on November 21, on his way to St. Petersburg, Fla., where he intended to spend his winter vacation. Mr. Jennings was also vice-president of the Johnston & Jennings Co. of Cleveland, manufacturer of forging and foundry equipment. He was a graduate of Yale University, and started his business career as a bookkeeper for the Peck, Stow & Wilcox Co. Later he became bookkeeper for the Lamson & Sessions Co. In 1884, he married Miss Lillian Lamson, a daughter of Isaac Lamson, one of the founders of the company.

He had been president of the Lamson & Sessions Co. for many years and was elected chairman of the board in 1929. Although eighty-one years old, he was at his office every day at 8:15 A.M. up to within a week of his death, and took an active part in directing the affairs of the company. He is survived by one son, I. L. Jennings, vice-president of the Lamson & Sessions Co.

ROBERT S. MACGARVIE, who had been connected with the Brown & Sharpe Mfg. Co. of Providence, R. I., for twenty-two years, died on November 26 after a long illness. Mr. MacGarvie started his career as an apprentice machinist in the factory at Providence in 1915. Since 1925 he had been a machine tool representative of Brown & Sharpe of New

York, Inc., and was well known among the metal-working industries in the metropolitan area.

JOHN G. REISING, general manager of the Cincinnati Electrical Tool Co., Cincinnati, Ohio, died on November 27 after a prolonged illness. Mr. Reising was

one of the pioneers in the electrical tool business of this country, and had been associated with the Cincinnati Electrical Tool Co. for nearly thirty years. A man of sterling character and recognized for his sense of fair play, he was affectionately known as Uncle John by the entire personnel of the company.

NEW BOOKS AND PUBLICATIONS

CHEVROLET SIX CAR AND TRUCK. By Victor W. Page. 776 pages, 5 by 7 1/2 inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, \$2.50.

This is a revised and enlarged edition of a book containing complete operating and maintenance instructions for all Chevrolet Six models, from 1931 to 1937, inclusive. The book is a non-technical treatise intended for owners, salesmen, operators, and repair men, covering the mechanical features, the operation, maintenance, and repair of Chevrolet cars and trucks. The construction and operation of the important parts of the chassis and power plant are so clearly described as to be understood even by a novice. Suggestions are given for driving and upkeep; solving troubles on the road and in the shop; power plant overhauling; systematic location of defects in the carburetion, cooling, and ignition systems; as well as complete lubricating instructions and descriptions of down draft carburetor, automatic heat control, new frame designs, etc. Instructions are given for servicing all the new units of the cars and trucks, as well as the parts of the millions of Chevrolet units previously built and in operation.

MODERN PLASTICS HANDBOOK AND CATALOGUE. 342 pages, 8 3/4 by 11 3/4 inches. Published by the Breskin & Charlton Publishing Corporation, 425 Fourth Ave., New York City. Price, \$2.

This handbook and catalogue on modern plastics presents new developments both in materials and equipment, with graphic illustrations which indicate the uses each type of plastic is best qualified to meet. The book is divided into seven sections covering materials; molding and fabricating; machinery and equipment; industrial and decorative laminated; product development; bibliography and nomenclature; and directory. The directory contains a classified list, arranged by products, of manufacturers of machinery, equipment, and supplies used in the production and in the molding and fabricating of plastic articles; a directory of custom molders, fabricators, and designers; a list of chemicals and raw materials used in

the manufacture of plastic compositions; and a list of trade names of plastics.

HOW TO HANDLE GRIEVANCES. By Glenn Gardiner. 52 pages, 5 1/2 by 7 1/2 inches. Published by the Elliott Service Co., 219 E. 44th St., New York City. Price, bound in leatherette, 60 cents; paper-bound, 45 cents.

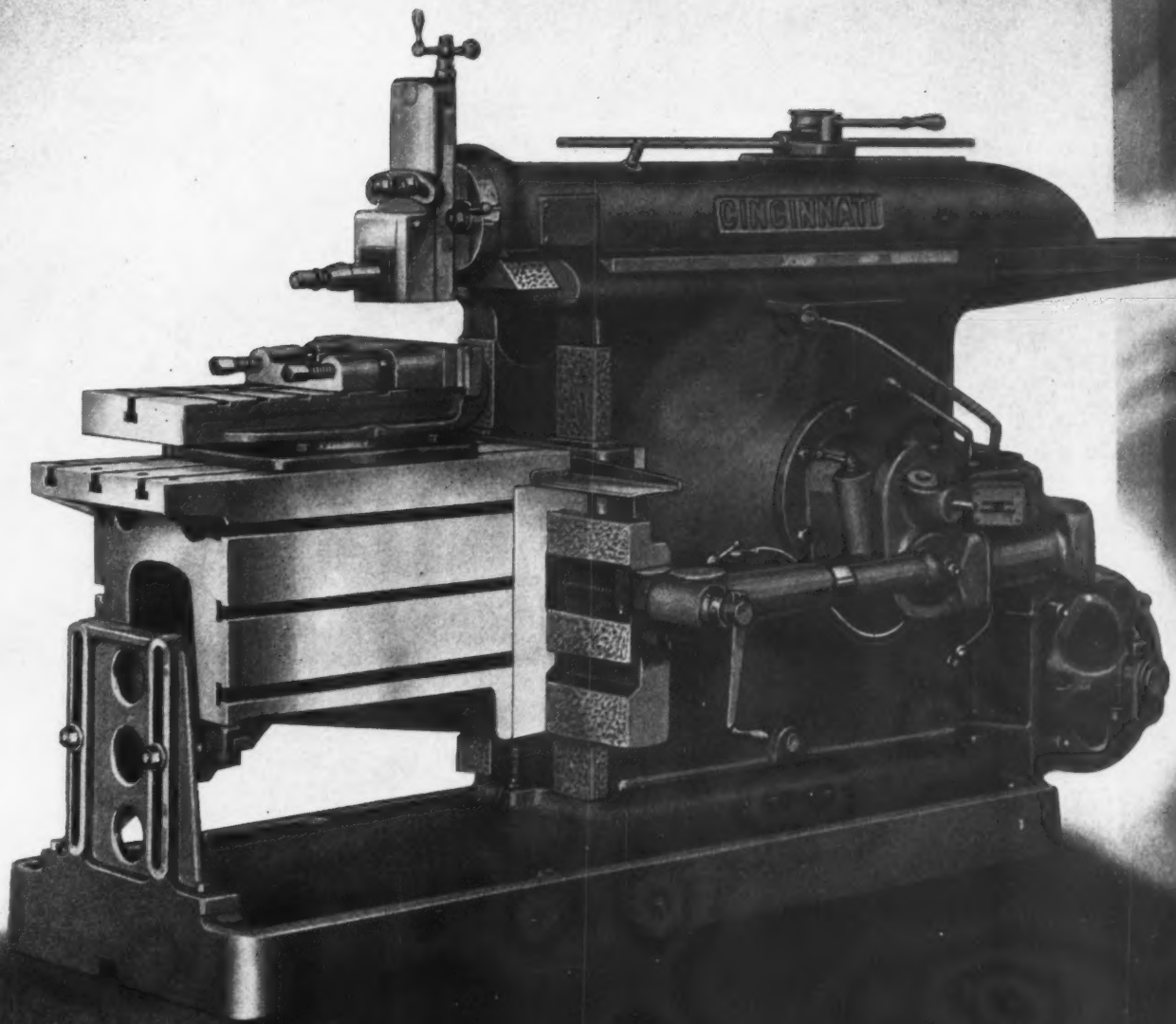
This little book has been written as a working manual for persons in supervisory positions with the object of aiding them in dealing with employee grievances in an intelligent manner. It is believed by the author that many of the major controversies arising within industrial organizations are the result of ill-advised handling or neglect of little grievances. The book is designed to present in a practical way the fundamental principles that have been found to be effective in handling grievances.

SECHSSTELLIGE WERTE DER KREIS- UND EVOLVENTEN-FUNKTIONEN (Six-Place Tables of Trigonometrical and Involute Functions). By Prof. Dr. J. Peters. 217 pages, 8 by 10 1/2 inches. Published by Ferd. Dümmlers Verlag, Berlin S.W. 68, Germany. Price, 15 Marks.

This is a work compiled by the Köllmann Works (Köllmann-Werke A.G.) of Leipzig, Germany, consisting of tables to six places, giving the sine, cosine, tangent, cotangent, secant, and cosecant, as well as the involute functions and radians for angles to hundredths of a degree. The book is also provided with an appendix, in German, giving tabulated values and formulas useful in the design of gearing.

GRINDING PRACTICE. By Fred H. Colvin and Frank A. Stanley. 310 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, \$3.

This book comprises a manual for the shop worker, shop executive, and planner, covering the field of modern grinding machines and abrasive wheels. It describes typical machines and the methods employed in grinding a variety of work. Detailed information is given on



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S H A P E R S

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B R A K E S

the operation of the machines and how to make the best use of them on different classes of work. Data on speeds, feeds, precision grinding, automatic machines, and special work are included.

THE INGOT PHASE OF STEEL PRODUCTION.

By Emil Gathmann. 76 pages, 6 3/4 by 10 inches. Published by the Gathmann Engineering Co., Baltimore, Md.

This book covers all of the more important steps in the production of steel, from the finishing of the heat to the initial reduction of the ingot in the mill. It points out the relationship between faulty practices in production and defects in the semi-finished and finished steel product.

COMBINED EFFECT OF CORROSION AND STRESS CONCENTRATION AT HOLES AND FILLETS IN STEEL SPECIMENS

SUBJECTED TO REVERSED TORSIONAL STRESSES. By Thomas J. Dolan. 42 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 293 of the Engineering Experiment Station. Price, 50 cents.

CALIBRATION OF TESTING MACHINES UNDER DYNAMIC LOADING.

By Bruce Wilson and Carl Johnson. 57 pages, 6 by 9 inches. Published by the Bureau of Standards, Washington, D. C., as Research Paper RP1009. Sold by Superintendent of Documents, Washington, D. C. Price, 10 cents.

TESTS OF THIN HEMISPHERICAL SHELLS

SUBJECTED TO INTERNAL HYDROSTATIC PRESSURE. By Wilbur M. Wilson and Joseph Marin. 22 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 295 of the Engineering Experiment Station. Price, 30 cents.

A SELECTED LIST OF THE PUBLICATIONS OF THE BUREAU OF LABOR STATISTICS.

1936 edition. Bulletin No. 624 of the United States Department of Labor. Obtainable from the Superintendent of Documents, Washington, D. C. Price, 10 cents.

FUSIBLE ALLOYS CONTAINING TIN.

By E. J. Daniels. 24 pages, 6 by 9 3/4 inches. Distributed by L. J. Tavenner, New York representative of the International Tin Research and Development Council, 149 Broadway, New York City.

TESTS OF STEEL COLUMNS.

By Wilbur M. Wilson. 42 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 292 of the Engineering Experiment Station. Price, 50 cents.

SYMPOSIUM ON WEAR OF METALS.

105 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, \$1.25.

COMING EVENTS

JANUARY 10-14—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MARCH 10-11—NATIONAL AERONAUTIC MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS at the Mayflower Hotel, Washington, D. C.

MARCH 21-25—WESTERN METAL EXPOSITION AND CONGRESS, in the Pan-Pacific Auditorium, Los Angeles, Calif., under the auspices of the American Society for Metals. W. H. Eisenman, managing director, 7016 Euclid Ave., Cleveland, Ohio.

MARCH 23-25—National spring meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Los Angeles, Calif. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MARCH 28-30—NATIONAL PASSENGER CAR MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Statler, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MAY 4-6—Machine Shop Practice meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Rochester, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 14-19—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago.

JUNE 12-17—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 20-24—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 27-JULY 1—Forty-first annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 260 S. Broad St., Philadelphia, Pa.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

Production Meeting of the Automotive Engineers

The 1937 production meeting of the Society of Automotive Engineers was held December 8 to 10 at the Hotel Durant, Flint, Mich. Sessions were held in the afternoon and evening of the three days, while two forenoons were set aside for plant visits, the Buick Plant No. 66, the AC Spark Plug Co.'s plant, and the Fisher Body Plant No. 1 being visited.

Ten papers were read dealing with the casting and machining of cast-steel pistons; precision forging practice; welding; the finishing of automotive parts by enameling; grinding; machining of automotive transmissions; and spline and gear cutting and finishing. All together, the program was one of the most complete and the number and interest of the technical papers the most impressive ever presented at one of the Society's production meetings. Some of the leading men in the automotive industry, each in his chosen field, had been drafted to present the unusual papers read before the meeting.

* * *

Proposed British Machine Tool Research Association

According to *Engineering*, it has been proposed to form in Great Britain a research association for the machine tool industry, with the assistance of the Department of Scientific and Industrial Research. It is understood that Dr. G. Schlesinger, formerly professor at the Charlottenburg Engineering Institute in Germany, may be asked to take charge of the laboratory which would be established in connection with the new research association.

CALENDARS RECEIVED

CARBORUNDUM Co., Niagara Falls, N. Y. NEW DEPARTURE DIVISION OF GENERAL MOTORS CORPORATION, Bristol, Conn. SKF INDUSTRIES, INC., Philadelphia, Pa. GENERAL ELECTRIC Co., Schenectady, N. Y. HYATT BEARINGS DIVISION, GENERAL MOTORS CORPORATION, Harrison, N. J.

* * *

It is obvious that the motor vehicle has taken a great deal of business away from the railroads. However, it has also given a great deal of business to the railroads. In 1936, there were 3,525,000 carloads of automotive freight shipped over American railroads.



R. A. McCarty, New Manager of Small Motor Division of Westinghouse Electric & Mfg. Co.



R. F. Frenger, Who Assumes Special Duties with Westinghouse on the Vice-president's Staff



F. H. Stohr, New Manager of the Generator Division of Westinghouse Electric & Mfg. Co.

and curves of shapes with other grades of insert material are also available. The Forgings and Castings Corporation is also prepared to supply Jessop rolled die section steel in bar, cut, and curved form.

JOSEPH HIGHDUCHECK has joined the Carboly Company, Inc., 2985 E. Jefferson St., Detroit, Mich., in the capacity of service engineer. Mr. Highducheck has had a wide experience with high-speed steel and cemented-carbide cutting tools. As assistant superintendent of the manufacturing equipment department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., he worked with cemented carbides when they were first introduced into this country in 1926, and has had numerous articles published on their use and application. He will be permanently located at the Pittsburgh office, but will also cover the Cleveland, Philadelphia, and Newark territories.

MANLEY PRODUCTS CORPORATION, State and Hay Sts., York, Pa., manufacturer of Remco valves, motor drives, and garage equipment, has changed its name to the REMCO PRODUCTS CORPORATION. There has been no change in the management nor corporate structure, the change in name having been made merely to secure uniformity in the name of the company and its products.

CLARENCE E. JACOBSEN has been elected vice-president of the Chicago-Latrobe Twist Drill Works in charge of the eastern territory, with headquarters in the Public Ledger Building, Independence Square, Philadelphia, Pa.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., announces the removal of its radio division from Chicopee Falls, Mass. to Baltimore, Md., where a modern manufacturing plant has been purchased at Wilkins Ave. and Catherine St.

R. A. McCARTY has been appointed manager of the Small Motor Division of the Westinghouse Electric & Mfg. Co., at Lima, Ohio, succeeding R. F. FRENGER, who has returned to East Pittsburgh to the vice-president's staff for other special duties. F. H. STOHR succeeds Mr. McCarty as manager of the Generator Division, with headquarters at East Pittsburgh.

Wisconsin

ROBERT L. HAMILTON has been made sales manager of the Dumore Co., Racine, Wis., manufacturer of universal motors and lathe grinders, to succeed LELAND B. AUGUSTINE, who is now in charge of Dumore sales in the Chicago territory. Mr. Hamilton also continues to hold the positions of advertising manager and sales promotion manager.



Robert L. Hamilton, Recently Appointed Sales Manager of the Dumore Co.

L. L. RICHARDS MACHINERY CO., Milwaukee, Wis., was recently incorporated as a machine tool dealer to serve the Wisconsin territory. L. L. RICHARDS was previously general manager of the Eadger-Packard Machine Co. of Milwaukee. C. R. DANIELS, formerly in the sales department of Joseph T. Ryerson & Son, Inc., has joined the new organization.

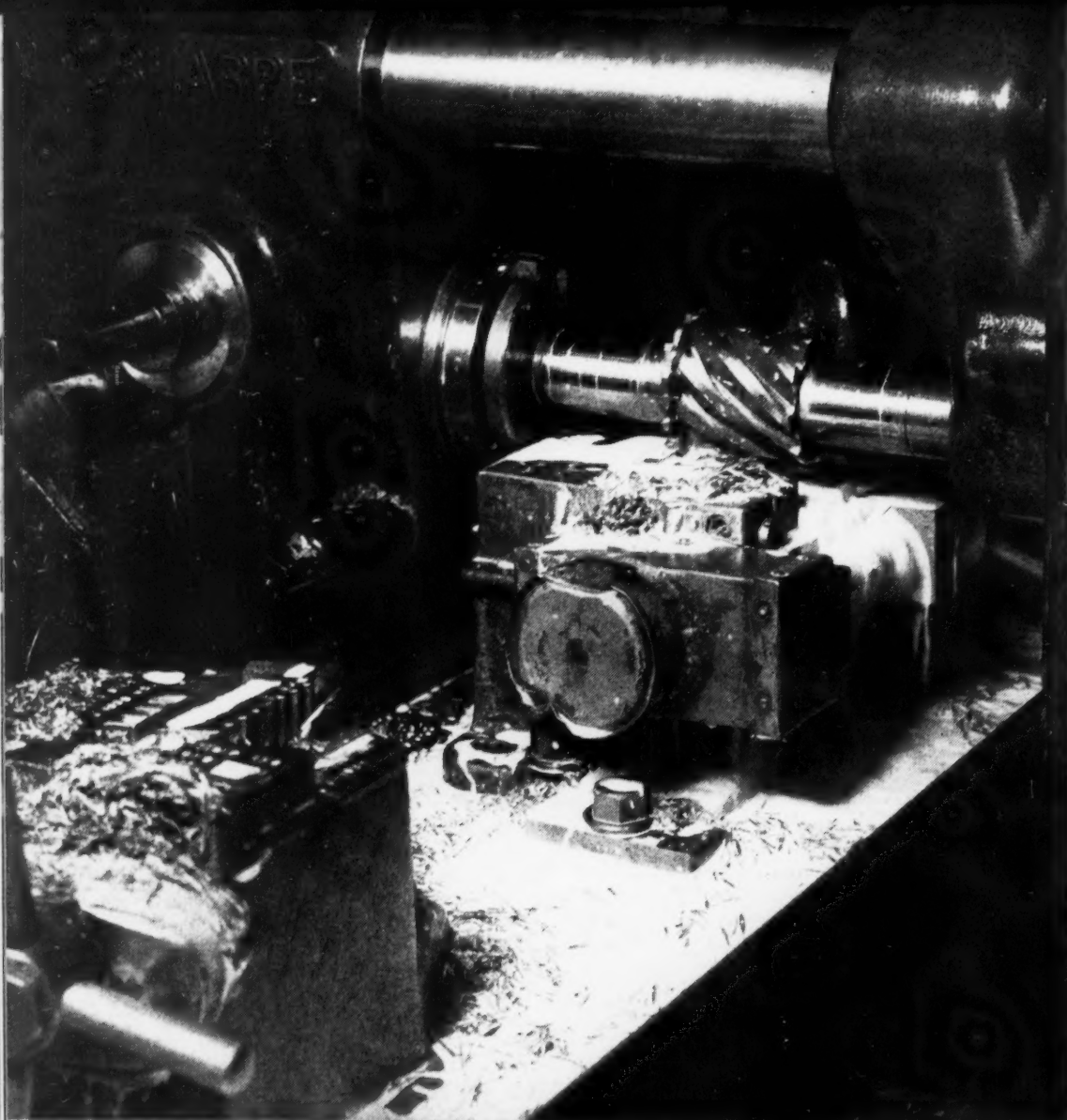
COMING EVENTS

FEBRUARY 3-4—THIRD WELDING CONFERENCE, to be held at the Texas Technological College, Lubbock, Tex. For further information, address J. C. Hardgrave, Department of Mechanical Engineering, Texas Technological College, Lubbock, Tex.

FEBRUARY 3-4—Regional conference of the AMERICAN FOUNDRYMEN'S ASSOCIATION, to be held at the Hotel Schroeder, Milwaukee, Wis. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

FEBRUARY 24-25—Sixth annual joint conference of foundrymen and engineers under the auspices of the AMERICAN FOUNDRYMEN'S ASSOCIATION, to be held at the Hotel Tutweiler, Birmingham, Ala. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill.

MARCH 9-12—Annual convention of the AMERICAN SOCIETY OF TOOL ENGINEERS at Convention Hall, Detroit, Mich., in conjunction with a Machine and Tool Progress Show, featuring machinery, tools, production equipment, and ma-

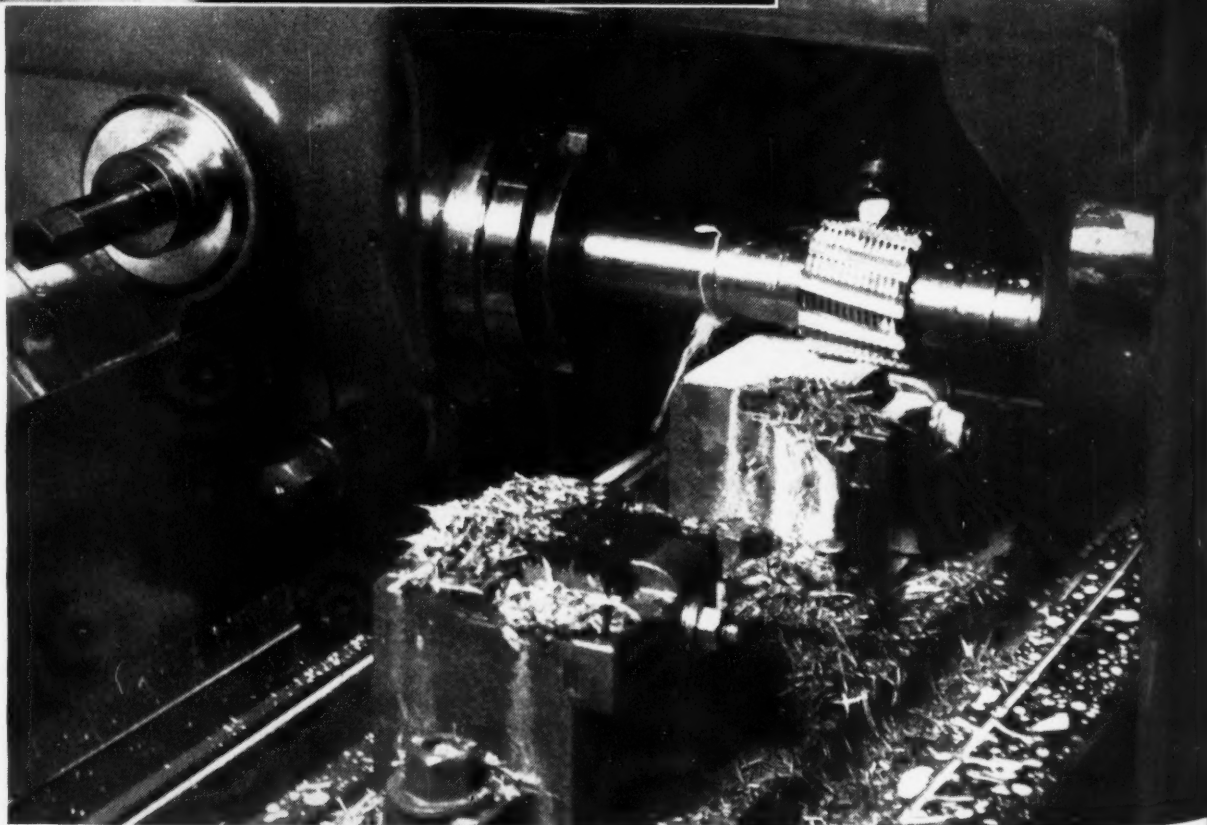


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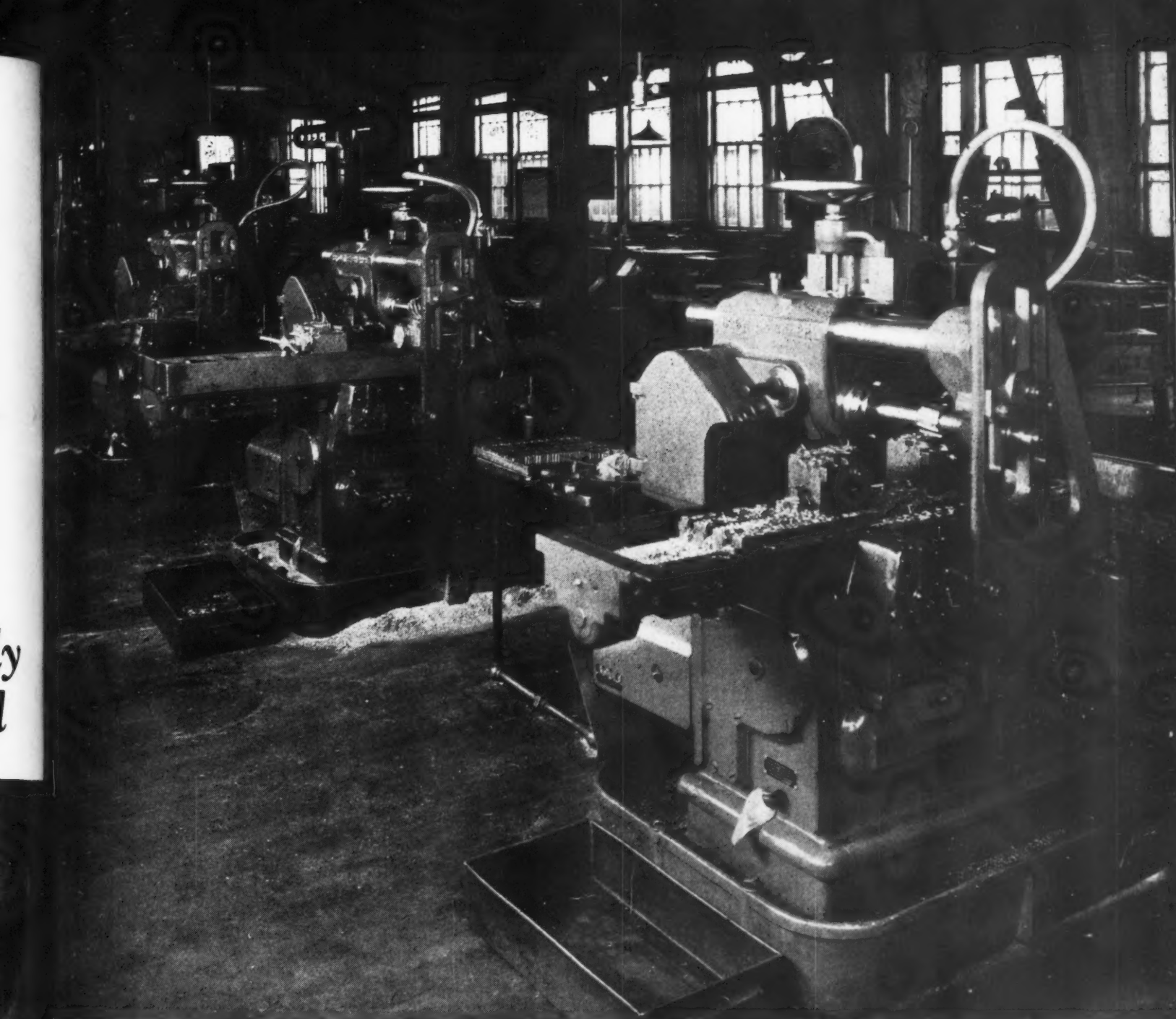


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Page 416-C

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terials. For further information, address American Society of Tool Engineers, 5928 Second Blvd., Detroit, Mich.

MARCH 10-11—NATIONAL AERONAUTIC MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS at the Mayflower Hotel, Washington, D. C.

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MARCH 28-30—NATIONAL PASSENGER CAR MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel Statler, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

APRIL 5-8—NATIONAL INVENTORS CONGRESS AND EXHIBITION in Chicago, Ill.; headquarters, Hotel Stevens. Roy C. Burns, managing director, Blum Bldg., Chicago, Ill.

APRIL 18-20—Twenty-second annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION, to be held at General Brock Hotel, Niagara Falls, Canada. J. C. McQuiston, manager-secretary, Penn-Lincoln Hotel, Wilkesburg, Pa.

MAY 4-6—Machine Shop Practice meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Rochester, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 14-19—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago.

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OCTOBER 17-21—NATIONAL METAL CONGRESS AND EXHIBITION, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

OBITUARIES

Tine P. Dickinson

Tine P. Dickinson, secretary-treasurer and general manager of the International Machine Tool Co., Indianapolis, Ind., died on December 22, after an illness of six weeks. Mr. Dickinson was born at Catlin, Ill., on September 22, 1888. His education was obtained in the public schools of Catlin and in the Business College in Danville, Ill. About thirty-



Tine P. Dickinson

one years ago he moved to Indianapolis, at which time he became connected with the International Machine Tool Co.

James G. Brown

James G. Brown, long connected with the machinery importing business in Japan and well known to machinery exporters in the United States, died recently at his home in Tokyo after a brief illness. Mr. Brown was born in Cleveland, Ohio. He served an apprenticeship in one of the Cleveland machine tool plants and later studied mechanical engineering in New York. In 1900, while still a young man, he was sent to Europe as a representative of an American machine tool builder, and represented American interests in Germany, Italy, Belgium, Austria, Russia, and the Scandinavian countries for several years. In 1905, he became Far Eastern representative of American interests, and later made his headquarters in Shanghai. In 1913, he changed his residence to Japan and established his home in Yokohama. In 1916, he returned to the United States, opening a buying office in New York for Yamatake & Co. of Tokyo. In 1923, he returned to Japan as representative of Carl Zeiss.

PAUL K. ROGERS, SR., president and treasurer of the Skinner Chuck Co., New Britain, Conn., died on January 11.

* * *

Correct Classification in Export Shipments

The Bureau of Foreign and Domestic Commerce, Washington, D. C., in order to be able to make its export statistics as accurate and useful as possible, is requesting all machinery exporters to make careful use of the classification schedules issued by the Bureau for export purposes.

All the government export figures are based upon the export declarations that machinery exporters or their forwarding agents fill out at their own plants or offices. If the official export statistics in some cases appear to be inaccurate, it is usually because inaccurate export declarations have been filled out by the shipping clerk or forwarder. Too often the preparation of shipping documents is turned over to men who are not familiar with the customs requirements, and serious errors in the final statistics may be caused by simply one or more exporters in the group whose declarations have been in error.

For this reason, the Bureau of Foreign and Domestic Commerce is making available a revised edition of "Schedule B, the Statistical Classification of Domestic Commodities Exported from the United States," which became effective January 1, 1938. Every manufacturer doing export business is urged to write to the Bureau for a copy.

Accurate export statistics can only be had if the proper officials in each manufacturing organization check up on their shipping departments from time to time, to make sure that the declarations properly classify the goods being exported.

* * *

Tool Engineers Plan Machine and Tool Exhibit

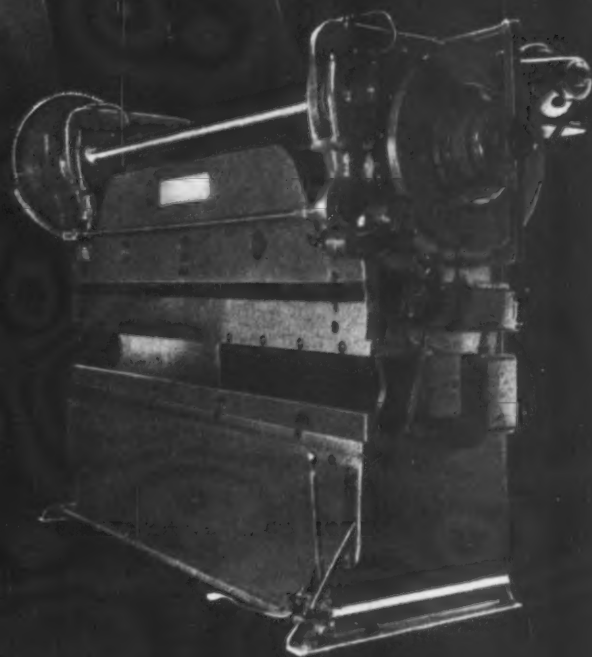
In conjunction with the annual convention of the American Society of Tool Engineers, 5928 Second Blvd., Detroit, Mich., March 9 to 12, the Society is planning to sponsor a Machine and Tool Progress Show featuring machinery, tools, shop equipment, and materials, for the mass-production industries. The exhibit will include, among other shop equipment, abrasives, grinding equipment, air-conditioning equipment, compressed air equipment, metal-finishing machinery, electric and air-operated tools, materials-handling equipment, furnaces, pyrometers, and automatic temperature controls.

* * *

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straight and true on Cincinnati
All Steel Press Brakes.
Deep bed and ram plates,
parallel within .005 inch
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NEW BOOKS AND PUBLICATIONS

FUNDAMENTALS OF MACHINE DESIGN. By C. A. Norman, E. S. Ault and I. F. Zarobsky. 486 pages, 6 by 9 inches. Published by the Macmillan Co., 60 Fifth Ave., New York City. Price, \$4.25.

In the preparation of this book, the authors state, emphasis has been placed on the fundamentals of machine design, as well as on the application of those fundamentals to the design of machine elements. Many illustrative examples have been included to show the application of the elements in composite machinery. The material is divided into twenty-five chapters, dealing with the following subjects: Design Procedure and Standardization; Strength of Materials; Engineering Materials; Manufacturing Processes; Riveted Pressure Vessels and Riveted Joints; Welding; Screw Threads; Cylinders, Pistons, and Stuffing Boxes; Linkages; Cams and Ratchets; Shafts, Keys, and Permanent Couplings; Plain Bearings and their Lubrication; Ball and Roller Bearings; Flywheels and High-Speed Rotors; Belts and Pulleys; Brakes and Clutches; Chains; Spur Gears; Helical Gears; Bevel Gears; Worm Gears; Methods of Forming and Finishing Gear Teeth; Wire Rope and Hoisting; Springs; Vibratory Stresses.

THE INTERNAL COMBUSTION ENGINE. By D. R. Pye. 294 pages, 6 by 9 inches. Published by the Oxford University Press, 114 Fifth Ave., New York City. Price, \$5.

This is the second edition of a work that sets down the principles underlying the design and operation of the internal combustion engine. Although dealing with principles rather than with details of practice, the book aims at giving the groundwork of a practical knowledge of the subject. In the second edition, the text has been brought up to date; the chapter on detonation has been largely rewritten in the light of recent research; and the section dealing with specific heats, dissociation constants, and the calculation of combustion temperatures has been entirely revised so far as numerical quantities are concerned. New articles have also been added on non-volatile liquid fuels and their combustion in the compression-ignition engine.

SEGMENTAL FUNCTIONS. By C. K. Smoley. 184 pages, 4 1/2 by 7 inches. Published by C. K. Smoley & Sons, Scranton, Pa. Price, \$5, net.

The aim of this book is to facilitate calculations involving circular work. It presents simple methods of solving a circular segment and of computing its area

when the segment is given with any two of its five parts, namely the arc, the chord, the radius, the central angle, and the height. This is achieved by the creation of a new mathematical entity—the segmental functions, which accomplish for the solution of the circular segment what the trigonometric functions have done for the solution of triangles. Numerous examples are given illustrating the application of these methods.

The book is divided into two parts: Part 1 contains tables of logarithms of segmental functions; lengths of a circular arc; logarithms of areas; functions of segments formed by regular inscribed polygons; ordinates for laying out a circular curve; and natural values of the alpha function, or arc to chord. Part 2 contains reprints from Smoley's "Parallel Tables of Logarithms and Squares" and an extension of logarithms of the English system of linear measure to 200 feet.

THE CHEMISTRY OF SYNTHETIC SURFACE COATINGS. By Dr. William Krumbhaar. 200 pages, 6 by 9 inches. Published by the Reinhold Publishing Corporation, 330 W. 42nd St., New York City. Price, \$4.

This book has been written in response to a need for detailed information on the physical and chemical principles on which the production of surface coatings of synthetic materials are based. The important principles of chemical reactions in the varnish kettle and of surface chemistry of pigments

and paints are discussed from a fundamental point of view, and in the same way, drier chemistry and the physical chemistry of surface coatings are reviewed.

MECHANICAL WORLD YEAR BOOK (1938). 360 pages, 4 by 6 1/4 inches. Published by Emmott & Co., Ltd., 31 King St., W., Manchester 3, England. Price, 1/6.

This is the fifty-first year of publication of this little handbook for mechanical engineers. The present edition includes an entirely new section on the subject of electric arc-welding, explaining the process in detail and describing the types and properties of electrodes. Directions are given for the various methods of welding, and welding design is also treated. In other respects, the book is the same as in previous editions, except for the regular revision and an extension of the index.

PROBLEMS IN BUILDING ILLUMINATION. By John O. Kraehenbuehl. 28 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Circular No. 29 of the Engineering Experiment Station. Price, 35 cents.

* * *

Lincoln Foundation Films on Welding

The James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio, announces that it has prepared a series of slide films on the application of electric welding to various products and structures. These slides have been prepared for educational purposes and are available to engineering societies, both national and local, technical clubs, trade schools, engineering colleges, and any other groups desiring to make use of them. Those interested are requested to communicate with the Foundation. The films are of the 35-millimeter type, each containing between forty and fifty individual illustrations. A typewritten explanation discussing the subject in practical language is provided to be read in connection with the films. A varied number of subjects will be available.

* * *

The George Westinghouse Commemoration

An attractively illustrated book commemorating George Westinghouse, and containing the addresses on the career and achievements of this great engineer presented before the American Society of Mechanical Engineers on the ninetytieth anniversary of his birth, is being distributed to those interested in the life work of George Westinghouse by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., free of charge as long as the supply of books on hand lasts.

It is expected that new plant purchases for the automotive industry this year will run into very high figures because of the great amount of retooling for new models that will take place this summer and fall. Millions of dollars will be spent by the automobile companies for new machine tools, tooling equipment, and small tools during the year. One estimate is that Michigan automotive plants may spend as much as \$20,000,000 for retooling alone.

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All-Steel Press Brakes offer record
performance • • •



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O. F. Stroman, Assistant to Vice-president in Charge of Sales, Westinghouse Electric & Mfg. Co.



C. B. Stainback, Manager of the Industrial Sales Department of Westinghouse Electric & Mfg. Co.



Bernard Lester, Manager of the Westinghouse Electric & Mfg. Co.'s New Resale Department

cleaning and pickling of strip, sheet, and wire, including rustproofing and coloring.

CHARLES BOND CO., 617 Arch St., Philadelphia, Pa., has appointed two new stock-carrying distributors for Bond stock gears, sprockets, and speed reducers, as follows: A. J. GLESENER CO., 975 Bryant St., San Francisco, Calif., and the CAMM-BLADES MACHINERY CO., 612 W. Michigan St., Milwaukee, Wis.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., announces that three executives associated with the industrial sales department have been promoted to new positions as follows: O. F. STROMAN, since 1931 manager of the industrial sales department, has

been appointed assistant to the vice-president in charge of sales. C. B. STAINBACK, formerly assistant manager of the industrial sales department, becomes manager. BERNARD LESTER, also a former assistant manager, has been made manager of a newly created resale department. Mr. Stroman and Mr. Lester will make their headquarters in the Pittsburgh offices of the company in the Union Bank Building. Mr. Stainback's office will be at the East Pittsburgh Works.

JAMES WEAVER, director of equipment of the Westinghouse Electric & Mfg. Co., recently addressed the Pittsburgh chapter of the American Society of Tool Engineers on the subject of a scale of standards for surface finishes, according to which finished surfaces would be divided into ten classifications.

J. K. B. HARE has been appointed central district manager of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. JOHN ANDREWS, JR., former district manager, joins the headquarters staff as assistant to vice-president in charge of sales.

CHARLES R. MOFFATT has been appointed director of advertising for the United States Steel Corporation of Delaware, 436 Seventh Ave., Pittsburgh, Pa. Mr. Moffatt has been advertising manager of the Carnegie-Illinois Steel Corporation since the organization of that company in October, 1935, and director of exhibits of the United States Steel Corporation since July, 1935.

G. REED SCHREINER has been appointed advertising manager of the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa. Mr. Schreiner, previously assistant advertising manager, succeeds CHARLES

R. MOFFATT, who was recently appointed director of advertising of the United States Steel Corporation of Delaware.

JOSEPH C. LANG, formerly works manager of Automatic Business Machines, Inc., Pittsburgh, Pa., has resigned to become chief engineer with Brooke L. Jarrett & Co., industrial engineers of the same city.

H. K. MCJUNKIN, 7800 Edgewood Ave., Swissvale, Pa., has been appointed district sales representative in the Pittsburgh area for the JAS. CLARK, JR., ELECTRIC CO., Louisville, Ky.

ALLEN W. MORTON has been elected vice-president of the American Hammered Piston Ring Division of the Koppers Co., Baltimore, Md. Mr. Morton was previously general manager.



Charles R. Moffatt, Director of Advertising, United States Steel Corporation of Delaware



G. Reed Schreiner, Advertising Manager of the Carnegie-Illinois Steel Corporation

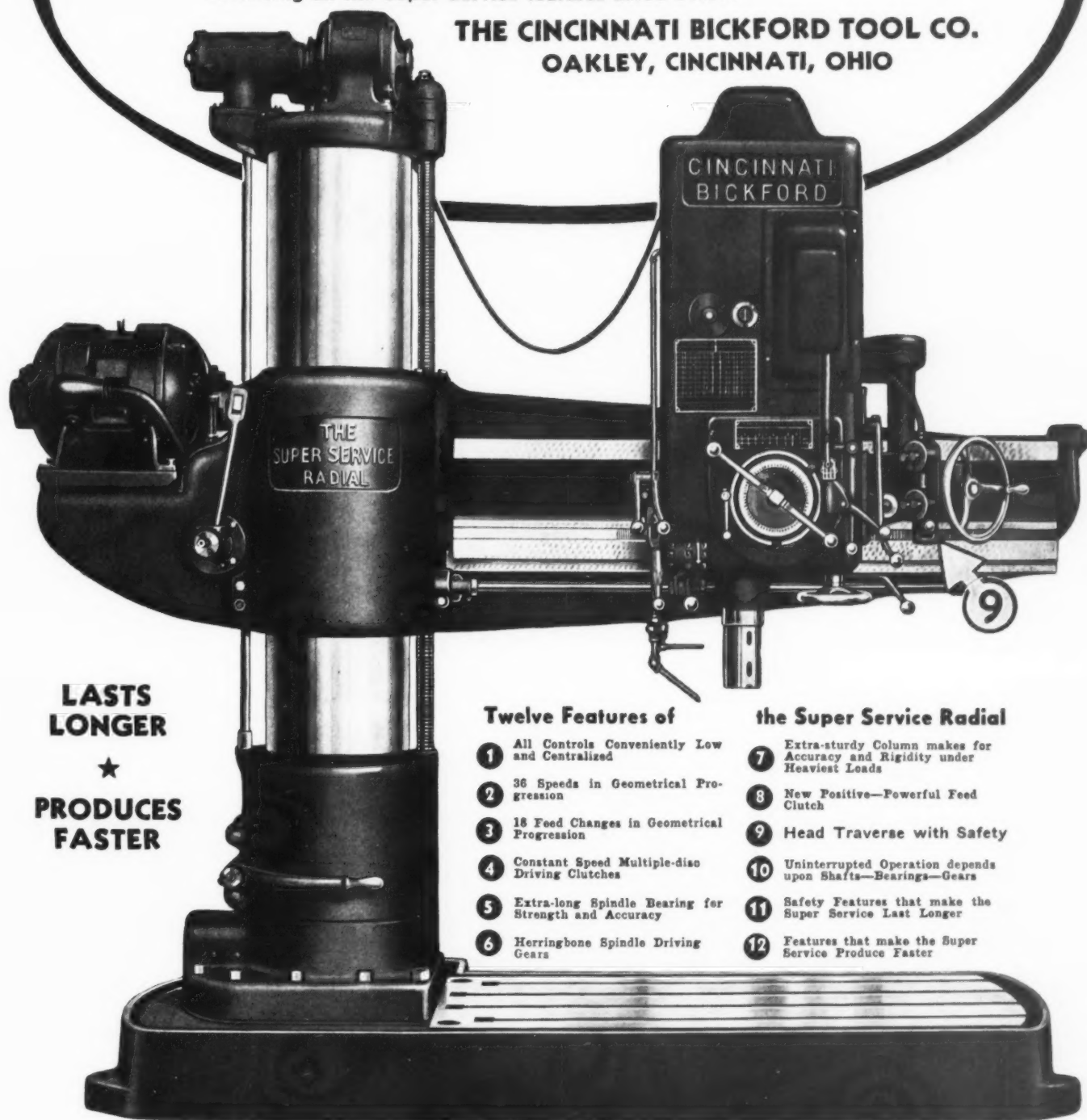
Head Traverse

—WITH SAFETY!

The rapid head traverse of the Super Service Radial saves time and energy and speeds up operations—with safety! Press the directional control lever and the head moves swiftly along the arm. No cranking is necessary; in fact, the *handwheel does not revolve except when turned by hand!*

Safety for the operator—and safety for tools and machine! The head automatically stops if it meets any obstruction. Tools are spotted quickly and accurately—the head does not coast past the mark. The Super Service traverse revolves in ball bearings and is automatically oiled. Send for bulletin R24 describing all the Super Service features listed below.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY, CINCINNATI, OHIO



**LASTS
LONGER**

★
**PRODUCES
FASTER**

Twelve Features of the Super Service Radial

- | | |
|--------------------------------------------------------|----------------------------------------------------------------------------|
| 1 All Controls Conveniently Low and Centralized | 7 Extra-sturdy Column makes for Accuracy and Rigidity under Heaviest Loads |
| 2 36 Speeds in Geometrical Progression | 8 New Positive—Powerful Feed Clutch |
| 3 18 Feed Changes in Geometrical Progression | 9 Head Traverse with Safety |
| 4 Constant Speed Multiple-disc Driving Clutches | 10 Uninterrupted Operation depends upon Shafts—Bearings—Gears |
| 5 Extra-long Spindle Bearing for Strength and Accuracy | 11 Safety Features that make the Super Service Last Longer |
| 6 Herringbone Spindle Driving Gears | 12 Features that make the Super Service Produce Faster |

Wisconsin

ALLIS-CHALMERS MFG. Co., Milwaukee, Wis., announces that its publicity department for power, electrical, and industrial machinery has been divided into two sections. One section is headed by GEORGE CALLOS, who has been appointed assistant manager in charge of sales promotion, embracing advertising, bulletins, exhibitions, house organs, etc. The other section is headed by A. K. BIRCH, assistant manager in charge of market analysis, sales organization service, embracing price books, data and sales information and the distribution of literature.

JOHN H. HOLZBOG, personnel director of the Chain Belt Co., Milwaukee, Wis., was recently awarded the Milwaukee Junior Chamber of Commerce Distinguished Service Award in recognition of his services in promoting industrial safety. The award was made by Dr. Glenn Frank.

DAVID B. HILL has been appointed sales engineer specializing in foundry systems for the Chain Belt Co., Milwaukee, Wis. Among the products that he will handle are mold conveyors, belt conveyors, sand conditioning systems, elevators, screens, etc.

OBITUARIES

CHARLES W. STONE, consulting engineer of the General Electric Co., Schenectady, N. Y., died at his home in Schenectady on February 3, of heart trouble, at the age of sixty-three. Mr. Stone graduated from the University of Kansas in 1894. In 1900, he joined the General Electric Co. in the drafting department and the following year was transferred to the switchgear engineering department. In 1904, he joined the lighting engineering department, and in 1912 was made manager of that department. In 1928, at his own request, he was released of managerial responsibilities and became consulting engineer of the company. Mr. Stone's chief interest was in radio and its associated developments. He had been active in the affairs of the Radio Corporation of America since the time of its inception, and in 1927, became assistant to James G. Harbord, then president of R.C.A. He was a member of many engineering and civic clubs.

J. B. STRONG, who has been the New England representative for the Fellows Gear Shaper Co., Springfield, Vt., for the last twenty-eight years, died on January 19.

NEW BOOKS AND PUBLICATIONS

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. 1012 pages, 6 by 8 3/4 inches. Published by the Lincoln Electric Co., Cleveland, Ohio. Price, \$1.50.

This is the fifth edition of a handbook on electric arc welding, covering welding methods and equipment; technique of welding; procedures and costs for welding mild steel; structure and properties of weld metal; weldability of metal; designing for arc-welded steel construction of machinery; designing for arc-welded structures; and typical applications of arc welding in manufacturing, construction, and maintenance. The new edition includes recent developments in arc welding and contains new or revised information on the following subjects: Characteristics of the welding generator; AWS weld symbols; welding costs; high-speed automatic welding; high tensile steels; cold-rolled steel; medium high-carbon steel; chrome steel; SAE steel numbering system; AWS filler metal specifications; machine design; and structural design. It also shows new welding applications in industrial fields.

METAL AIRPLANE STRUCTURES. By Major Flavius Loudy. 455 pages, 6 by 9 inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, \$5.

This is a treatise on the design and construction of the major parts of various types of metal airplanes, written by an expert designer of airplane and airship structures. It discusses the underlying principles of design, materials of construction, structural elements, welded joints, riveted joints, stressed skin design, metal wings, metal beams, fuselage, and hull and float design. It contains many useful tables, formulas and engineering drawings for the student, designer, and engineer.

ELECTRICAL YEAR BOOK (1938). 312 pages, 4 by 6 inches. Published by Emmott & Co., Ltd., 31 King St., W., Manchester 3, England. Price, 1/6, net.

This is the thirty-first year of publication of a little handbook for electrical engineers. The present edition has been revised and some new material has been added. Particular attention has been given to certain aspects of power generation and distribution, new information being given on phase sequence, symmetrical components, leakage protection, distance protection, and protection of alternating-current motors.

SYMPOSIUM ON CORROSION TESTING PROCEDURES. 131 pages, 6 by 9 inches. Published by the American Society

for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price, paper-bound, \$1.25; cloth-bound, \$1.50.

This publication includes seven technical papers on corrosion testing by twelve authorities, presented at the 1937 regional and annual meetings of the A.S.T.M. Extensive discussions of each paper are included.

THE HOUSING PROGRAM VERSUS RENT AND POPULATION TRENDS. By Allen W. Rucker, in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. No. 25 in a series of booklets published by the company on economic subjects. Available for free distribution by application to the Farrel-Birmingham Co.

SAVINGS AND AMERICAN PROGRESS. A Sequel to "Capital Goods and American Progress" and Further Discussion of the Relation of Wealth-Creating Enterprise to Employment and the American Standard of Living. 36 pages, 5 1/2 by 8 1/2 inches. Obtainable on application to the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill.

PROGRESS IN IMPROVEMENT OF CAST IRON AND USE OF ALLOYS IN IRON. By Paul D. Merica. 46 pages, 6 by 9 inches. Distributed by the International Nickel Co., Inc., 67 Wall St., New York City.

This booklet contains a reprint of the Henry Marion Howe Memorial Lecture, read before the American Institute of Mining and Metallurgical Engineers.

JOURNAL-BEARING DESIGN AS RELATED TO MAXIMUM LOADS, SPEEDS, AND OPERATING TEMPERATURES. By Samuel A. McKee. 9 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper RP1037 of the National Bureau of Standards. Price, 5 cents.

TESTS OF STRENGTH PROPERTIES OF CHILLED CAR WHEELS. By Frank E. Richart, Rex L. Brown, and Paul G. Jones. 70 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 294 of the Engineering Experiment Station. Price, 85 cents.

REPORT OF THE RESEARCH AND EXTENSION ACTIVITIES OF THE ENGINEERING SCHOOLS AND DEPARTMENTS FOR THE SESSIONS OF 1936-1937. 44 pages, 6 by 9 inches. Published by Purdue

HOW YOU CAN GET MORE PRODUCTION — BETTER FINISH AND LONGER WHEEL LIFE

Grinder performance depends on the accuracy of grinding wheel spindle bearings, which must have minimum end and radial play, must not generate excessive heat, and must stand the gaff for months without adjustment or replacement.

To incorporate all these features, Ex-Cell-O designed a special Precision Bearing with balls selected to exact size and roundness, for its Spindles. These balls make a three-point contact with the races, giving them a spinning motion and presenting the whole surface of each ball for wear. Between the balls and the races a perfect but very narrow contact is "developed" or run in, permitting sustained high speed without overheating and prolonging bearing life.

The accuracy of Ex-Cell-O Precision Ball Bearing equipped Spindles produces a superior finish grind that cuts rejections to a minimum and in some cases eliminates subsequent lapping or polishing operations. Decreased vibration prolongs wheel life, and often makes possible the use of a softer wheel.

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DRILL JIG BUSHINGS, GRINDING SPINDLES, HYDRAULIC POWER UNITS, PRECISION BORING AND FACING MACHINES, PRECISION THREAD GRINDERS, COUNTERBORES, BROACHES, CARBIDE TOOL GRINDERS, CARBOLOY TIPPED TOOLS, SPECIAL HIGH PRODUCTION MACHINES, GROUND FORM TOOLS, PRECISION PARTS, MILLING CUTTERS

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Please send me, without obligation, your latest catalog on Grinding Spindles (Also, on the products I have checked at the left).

Name Title

Company

Address

University, Lafayette, Ind., as Pamphlet No. 57 of the Research Series.

AN INVESTIGATION OF STUDENT STUDY LIGHTING. By John O. Kraehenbuehl. 35 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Circular No. 28 of the Engineering Experiment Station. Price, 40 cents.

* * *

Fred L. Eberhardt Celebrates Seventieth Birthday

On February 27, Fred L. Eberhardt, president and general manager of Gould & Eberhardt, Irvington, N. J., celebrated his seventieth birthday. Mr. Eberhardt has been connected with his company for fifty-seven years, having started to work for his father in 1881 at the age of thirteen. In 1901, he became president and general manager, a position that he has held ever since.

Mr. Eberhardt is recognized as one of the leaders in the machine tool industry. He was president of the National Machine Tool Builders Association from 1907 to 1909, and has always taken an active part in the affairs of the Association. He has been a member of the American Society of Mechanical Engineers for forty-nine years, and of the Automotive Engineers for twenty years.

Mr. Eberhardt has also been active in a number of educational and civic activities. He is vice-president of the Board of Trustees of the Newark Technical School and the Newark College of Engineering, a member of the Newark Chamber of Commerce, and a director of the Fidelity Union Trust Co.

Mr. Eberhardt sailed February 26 on the *Europa* for the Leipzig Fair, and thus celebrated his birthday at sea.



Fred L. Eberhardt

COMING EVENTS

MARCH 9-12—Annual convention of the **AMERICAN SOCIETY OF TOOL ENGINEERS** at Convention Hall, Detroit, Mich., in conjunction with a Machine and Tool Progress Show, featuring machinery, tools, production equipment, and materials. For further information, address American Society of Tool Engineers, 5928 Second Blvd., Detroit, Mich.

MARCH 10-11—**NATIONAL AERONAUTIC MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS** at the Mayflower Hotel, Washington, D. C.

MARCH 21-25—**WESTERN METAL EXPOSITION AND CONGRESS**, in the Pan-Pacific Auditorium, Los Angeles, Calif., under the auspices of the American Society for Metals. W. H. Eisenman, managing director, 7016 Euclid Ave., Cleveland, Ohio.

MARCH 23-25—National spring meeting of the **AMERICAN SOCIETY OF MECHANICAL ENGINEERS** at Los Angeles, Calif. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MARCH 28-30—**NATIONAL PASSENGER CAR MEETING OF THE SOCIETY OF AUTOMOTIVE ENGINEERS** at the Hotel Statler, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

APRIL 5-8—**NATIONAL INVENTORS CONGRESS AND EXHIBITION** in Chicago, Ill.; headquarters, Hotel Stevens. Roy C. Burns, managing director, Blum Bldg., Chicago, Ill.

APRIL 25-27—Twenty-second annual meeting of the **AMERICAN GEAR MANUFACTURERS ASSOCIATION**, to be held at General Brock Hotel, Niagara Falls, Canada. J. C. McQuiston, manager-secretary, Penn-Lincoln Hotel, Wilkesburg, Pa.

MAY 4-6—Machine Shop Practice meeting of the **AMERICAN SOCIETY OF MECHANICAL ENGINEERS** at Rochester, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 14-19—Convention and exhibition of the **AMERICAN FOUNDRYMEN'S ASSOCIATION** to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago.

JUNE 12-17—Summer meeting of the **SOCIETY OF AUTOMOTIVE ENGINEERS** at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 20-24—Semi-annual meeting of the **AMERICAN SOCIETY OF MECHANICAL ENGINEERS** at St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 27-JULY 1—Forty-first annual meeting of the **AMERICAN SOCIETY FOR TESTING MATERIALS** at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 260 S. Broad St., Philadelphia, Pa.

JULY 25-29—**INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION** in Berlin, Germany. Further information may be obtained by addressing the Bureau International de L'Enseignement Technique, 2 Place de la Bourse, Paris (2e), France.

SEPTEMBER 21-23—Sixteenth annual conference of the **NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION** at the Hotel Statler, Cleveland, Ohio. Stanley Kniseley, general conference chairman, Republic Steel Corporation, Cleveland, Ohio; Ralph Leavenworth, program committee chairman, Fuller & Smith & Ross, Inc., Cleveland, Ohio. For further information, communicate with J. A. Martz, 400 W. Madison St., Chicago, Ill.

OCTOBER 10-14—**NATIONAL SAFETY CONGRESS**, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 17-21—**NATIONAL METAL CONGRESS AND EXHIBITION**, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 11-19—**NATIONAL AUTOMOBILE SHOW** at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

* * *

Management Conference at the University of Iowa

A management conference devoted to the consideration of methods of wage payment and motion and time study, sponsored by the College of Engineering of the University of Iowa, the Iowa Manufacturers Association, and the Tri-Cities Section of the American Society of Mechanical Engineers, will be held at the State University of Iowa, Iowa City, Iowa, Friday, April 8. An unusually comprehensive program has been provided, with forenoon and afternoon sessions, and with papers at luncheon and dinner meetings. This is expected to be one of the outstanding management conferences held in recent years in the Middle West. Ralph M. Barnes, Professor of Industrial Engineering, University of Iowa, is chairman of the Meetings Committee.

SHOP EQUIPMENT SECTION



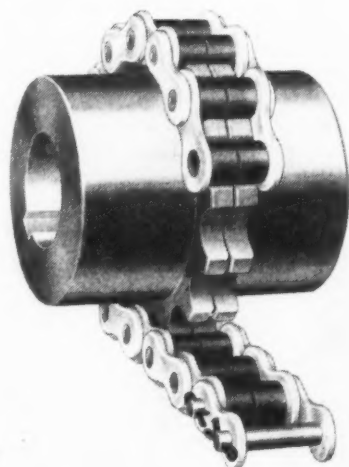
Collet Chuck for Screw Machines,
Made by Universal Engineering Co.

simplifying the setting of the tool. For adjusting in two directions, the keys can be removed.

The collets are the same type used in the Universal collet chucks for holding end-mills, Woodruff keyway cutters, and center points. The new chuck will hold a drill even though it is gripped on the fluted section. In many cases, it is not necessary to cut off new drills when only a short projection of the cutting flute is required.101

Link-Belt Flexible Couplings

The Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., has developed a new flexible coupling,



Link-Belt Flexible Coupling with
Divided-roller Connecting Chain

designated the Type RCB, for use in connecting shafting, which embodies important improvements over the previous Type RC coupling. The new coupling consists of two sprocket wheels connected by a piece of single-width roller chain, using a recently patented divided roller which provides independent roller action for each sprocket, thus eliminating any tendency of the rollers and sprocket teeth to "scuff."

Other improvements pertain to the grease-retaining housing or casing which can be furnished to serve as an enclosure and for automatic lubrication of the coupling. The most outstanding of these improvements is the use of two fittings, 180 degrees apart, to permit packing the housing with grease without dismantling it. Another improvement is in the seal used between the two halves of the coupling to avoid leakage of grease.102

Armstrong Wrenches for Hollow Screws

A new line of wrenches for hollow screws has been announced by the Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill. A wrench of the size, shape, and length desired can be assembled from a set of interlocking drivers, handles, extensions, and ratchets contained in a set of these tools.

The hollow-screw wrench resembles, in general, the detachable head of a socket wrench, but in place of a socket to fit over a screw-head, there is a protruding hexagonal driver that fits into the hollow screw. Ten sizes fit all hexagonal nut hollow screws and cap-screws from 1/4 to 1 inch in diameter. The AL-100 set illustrated consists of ten wrenches, two reversible ratchets, three sliding T-handles, two extensions, and an adapter in a fitted steel case. The wrenches, handles, and extensions are made of chrome-vanadium tool steel. The reversible ratchets are drop-



Wrenches for Hollow Screws, Made
by the Armstrong Bros. Tool Co.

forged, with hardened steel gears. All wrenches and parts are chromium-plated.103

Wheelco Portable Potentiometer

The Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill., has placed on the market a new portable potentiometer especially designed for use in the field or laboratory. This instrument is built in three different models: The Model 310 with cold junction compensator; the Model 320 with cold junction compensator and run-up box; and the Model 330 with cold junction compensator, run-up box, and



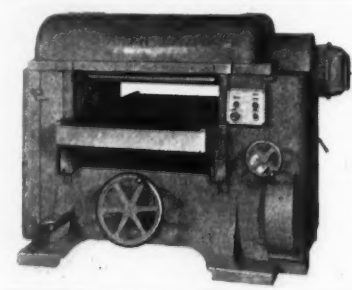
Portable Potentiometer Made by
Wheelco Instruments Co.

SHOP EQUIPMENT SECTION

standard thermo-couple line compensating rheostat. When used with the thermo-couples, this unit serves as an accurate checking instrument for direct-reading pyrometers. The scales are obtainable calibrated either in millivolts or in degrees Fahrenheit or Centigrade, or both. 104

Crescent 24-Inch Planer

A 24-inch "pony" planer with all guards made of aluminum has been brought out by the Crescent Machine Co., Leetonia, Ohio. The top hood of this planer is hinged at the back and can be lifted out of the way to give free access to



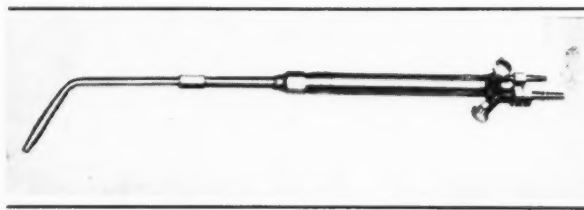
Crescent Planer Equipped with Aluminum Guards

the feed-rolls, chip-breaker, pressure bar, and cutter-head. All rolls are power-driven, the feed being through a Reeves drive which gives a continuous change of feeding speeds from 20 to 60 feet per minute.

The cutter-head is of the four-knife, round safety type and is direct connected to a motor of either 5, 7 1/2, or 10 horsepower. The head motor is connected to a start and stop button, and the feed motor is connected to a start, stop, brake and reverse button. 105

Oxweld Heavy-Duty Welding Blowpipe

To meet the need for a welding blowpipe of large capacity for heavy welding and heating oper-



Oxweld Blowpipe for Heavy-duty Welding

ations, the Linde Air Products Co., 205 E. 42nd St., New York City, has brought out the Oxweld W-26 welding and heating blowpipe here illustrated. This blowpipe is intended for welding and heating ranges above those for which previous types of Oxweld blowpipes were designed.

In spite of its large capacity, the new blowpipe operates efficiently on acetylene pressures of from 1 to 5 pounds per square inch. For extremely heavy work that would otherwise necessitate the use of heat shields, extensions are available, which lengthen the blowpipe assembly from 16 to 20 inches. This extension permits welding in inaccessible positions and also enables the operator to remain at a greater distance from the point of heat application. 106

Improved Revolution Counter

The Belden revolution counter recently acquired by the Ideal Commutator Dresser Co., 1011



Counter Placed on the Market by the Ideal Commutator Dresser Co.

Park Ave., Sycamore, Ill., has been improved in several respects. An outstanding feature of this counter is its ability to operate accurately at high speed. It is applicable to a wide field of winding operations in production lines, motor repair

shops, radio shops, and industrial maintenance shops, or to any type of work that requires a record of the number of turns made by a machine shaft or part.

One pointer indicates the number of turns from 0 to 100 and the other indicates the number of hundreds of revolutions counted. The counter will automatically subtract from the total when unwinding turns. 107



Improved Carbon-steel Wrench Made by J. H. Williams & Co.

Williams Improved Carbon-Steel Wrenches

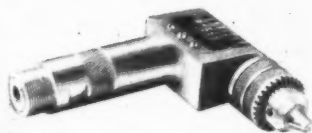
An improved type of carbon-steel wrench has been brought out by J. H. Williams & Co., 61 Spring St., New York City, in a complete standard line consisting of fifty patterns and more than one thousand sizes. These wrenches are approximately twice as strong as the old-fashioned carbon-steel wrenches and average 93 per cent as strong as alloy-steel wrenches of similar size. Tests show that these "Superior" carbon-steel wrenches are actually stronger than the double-head engineer's pattern alloy wrenches of thin design. Other advantages claimed include better hand grip and a safer grip on the nut.

The carbon-steel wrenches are recommended by the company

for most industrial uses, and the chrome-molybdenum wrenches for automotive and other purposes where operation in close quarters is required, where higher polish and chrome plate is desired, or where the 7 per cent additional strength is essential. These improved wrenches cost no more than the old-fashioned carbon-steel wrenches, and considerably less than alloy wrenches. 108

Close-Corner Angle-Head for Flexible Shaft

A full-speed angle-head for a flexible shaft, which is especially designed for drilling and filing in close quarters, has been brought out by the Stow Mfg. Co., Inc., Binghamton, N. Y. This

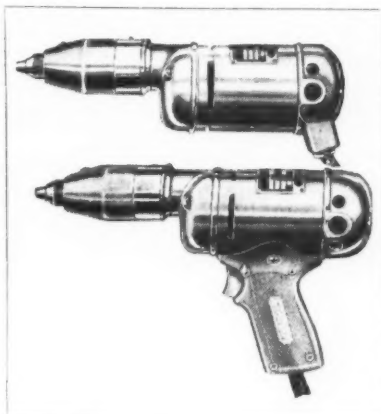


Stow Angle-head for Flexible Shaft

head is equipped with miter gears and ball thrust bearings. It is furnished with a 1/4-inch Jacobs chuck for holding drills, rotary files, rasps, mounted wheels, etc., and is recommended for use with a 1A, 2A, or 3A flexible shaft. 109

Stanley Electric Screwdrivers

The Stanley Electric Tool Division of Stanley Tool Works, New Britain, Conn., announces two portable electric screwdrivers, designated the Nos. 02 and 02H, for use wherever screws or nuts are used in assembly work. The outstanding features of these drivers are their light weight, compactness, and balance, which permit their use in close-quarter and long-reach work.

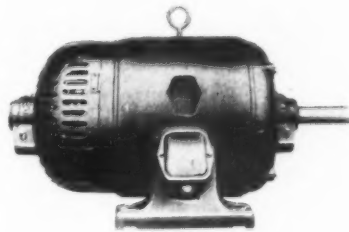


Stanley Electric Screwdrivers
Designed for Production
Assembling

Both screwdrivers are available with four driving speeds and are equipped with patented adjustable-tension clutches. The No. 02 model has an enclosed "on" and "off" switch mounted in the rear end bell, while the No. 02H has an automatic pistol type handle with a double-pole trigger type switch. 110

Wagner Motor with Low-Current, High-Torque Starting Characteristics

A Type RT polyphase motor has been developed recently by the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., for use where low starting current and high starting torque, combined with satisfactory operating characteristics and good speed regulation, are major requirements. Should this motor become accidentally locked, a



Wagner Low-current, High-torque Motor

thermal device breaks the circuit and disconnects the motor from the line. The thermal device also operates in the same way in case the low-resistance winding becomes accidentally open-circuited. This motor is available in a large variety of ratings, but will ordinarily be built in sizes of 40 horsepower and larger. 111

Correction

In the article describing the new 20 series of electrically controlled grinding machines, recently brought out by the Brown & Sharpe Mfg. Co., Providence, R. I., which was published in March MACHINERY, page 461, the headstock speeds were given as ranging from 80 to 120 revolutions per minute. These speeds should have been given as 80 to 320 revolutions per minute.

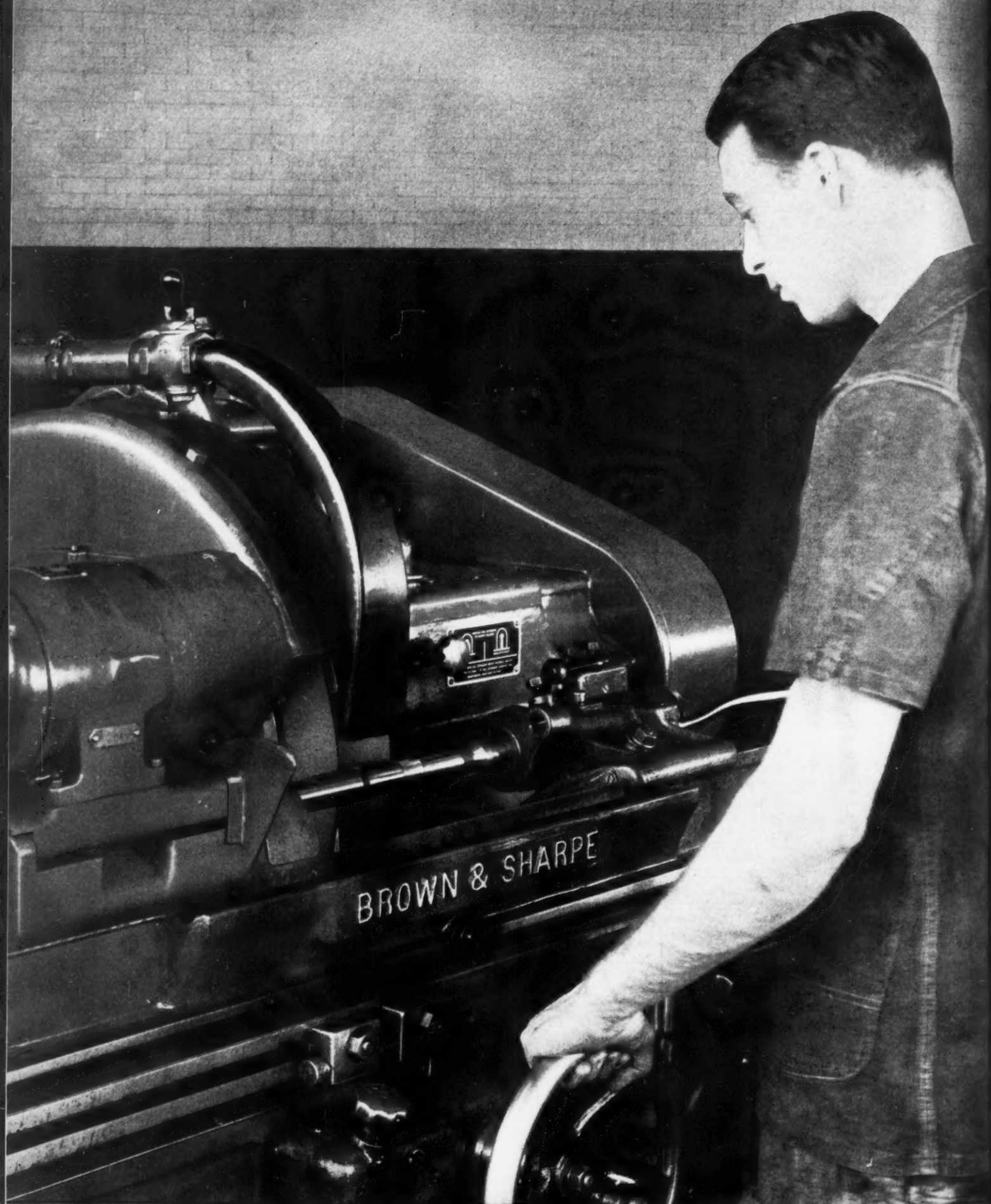
* * *

A Bronze Welding Repair Job

Five years ago, a two-ton press plunger and guide of a 100-ton press used in a trunk manufacturing plant were damaged. The plunger was fractured in two directions and the guide cracked in two parts. Repairs were made by bronze-welding. The machine has been in continuous operation ever since and has never given any further trouble. For the last year, it has been used for shaping angle-irons from 3/8-inch plate steel. This operation subjects the welded parts to great strain, but they show no evidence of distress. The entire work connected with the bronze-welding repair cost less than \$150 and was completed in three days. New parts would have cost \$750 and would have caused a long delay.

* * *

About 175 rubber parts are used in an automobile, according to the B. F. Goodrich Co. Of these, 140 are used in the chassis, and approximately 35 in the body of the car.



BROWN &

Introducing . . .

Nº10-6" x 18" and Nº12-6" x 30"

**Electric-Hydraulic Type
New Plain Grinding Machines**

**. . . in the Complete
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**-Ask for specifications
of the sizes suited to
your requirements.**

5- 3" x 12" and 3" x 18"

10- 6" x 18" 12- 6" x 30"

20-10" x 18" 22-10" x 36"

30-12" x 18" 32-14" x 36" 33-14" x 48"



For equipment for **Profitable Production Grinding**,
write—Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.

Page 582-E

SHARPE

NEWS OF THE INDUSTRY

Indiana and Illinois

S. R. THOMAS has been appointed chief engineer of the Bantam Bearings Corporation, South Bend, Ind. For the last year and a half, Mr. Thomas has been manager of the automotive bearing di-



S. R. Thomas, Chief Engineer of Bantam Bearings Corporation

vision, becoming connected with the Bantam Bearings Corporation after an association of four years with the Cord interests, where he was chief engineer of the Auburn, Cord, and Duesenberg plants.

GEORGE SCHERR Co., 128 Lafayette St., New York City, has opened a Chicago sales office at 565 W. Washington Blvd. (Machinery Sales Building), with JOHN M. GRAVEN in charge. The new office will serve the territory of Illinois, northern Indiana, Wisconsin, and Iowa.

Michigan

CARBOLLOY COMPANY, INC., 2985 E. Jefferson Ave., Detroit, Mich., manufacturer of cemented-carbide tools and dies, has completed plans for the construction of a new factory and general offices which will cost approximately \$500,000. The new plant will be located on a forty-acre tract of land on the north side of 8-Mile Road, one-half mile east of Van Dyke, and will be ready for occupancy in the fall of this year. It is being designed to accommodate the entire manufacturing facilities of the Carbolloy plants, which are now operated in three separate units at Cleveland, Ohio; Stam-

ford, Conn.; and Detroit, Mich. The plant will consist of three buildings—a two-story general office building, a one-story building with an area of 100,000 square feet which will be devoted to manufacturing, and a two-story structure of 18,000 square feet which will house the research laboratories and factory offices. With the plant operating at full capacity, approximately 500 persons will be employed.

FLOYD W. EATON, supervisor of apprentices of the Burroughs Adding Machine Co., Detroit, Mich., has been elected chairman of the Detroit Chapter of the American Society of Tool Engineers for the coming year.

WELCH TOOL & MFG. CO., INC., 11725 Strathmoor Ave., Detroit, Mich., manufacturer of milling cutters, form cutters, and special tools, has changed its name to the ATLAS TOOL CO.

ROY EVANS has been appointed assistant general sales manager of the Federal Motor Truck Co., Detroit, Mich., in charge of western territory.

New England

L. HERES DE WYK & Co., Ansonia, Conn., are successors to L. HERES DE WYK & SON. This is a change of name only, the firm continuing to carry on its business as a machinery dealer. L. HERES DE WYK, SR., is manager. ROBERT P. WALLER, D. T. GATELY, and I. L. BURRITT have been added to the sales force. The following companies are now represented: A. B. FARQUHAR Co., LTD., York, Pa.; ZEH & HAHNEMANN Co., Newark, N. J.; SERVICE MACHINE Co., Elizabeth, N. J.; HACK UNIVERSAL DIE MAKING MACHINE Co., Chicago, Ill.; MELLAPHONE CORPORATION, Rochester, N. Y.; SHAW-BOX CRANE & HOIST DIVISION OF MANNING, MAXWELL & MOORE, INC., Muskegon, Mich.; and C. B. HUNT & SONS, Salem, Ohio.

LYMAN A. SMITH, 410 Asylum St., Hartford, Conn., has organized a machinery sales agency and will represent the following firms: CHARLES G. ALLEN Co., Barre, Mass., manufacturer of drilling and tapping machines; KINGSBURY MACHINE TOOL CORPORATION, Keene, N. H., manufacturer of automatic drilling, tapping, threading, and milling machines; MONARCH MACHINE TOOL Co., Sidney, Ohio, manufacturer of tool-room and engine lathes, automatic form turning machines, and production lathes; and VAN NORMAN MACHINE TOOL Co., Springfield, Mass., manufacturer of universal milling machines.

J. B. CAREY has been appointed representative in northern Illinois, Wisconsin, Iowa, and Minnesota for the A. F. HOLDEN Co., New Haven, Conn., metallurgical engineers. Mr. Carey was previously chief metallurgist of the New Process Gear Corporation, Syracuse, N. Y.

GEORGE H. REAMA has been made factory manager of the American Screw Co., Providence, R. I. From 1911 to 1920, Mr. Reama was connected with the Winchester Repeating Arms Co., and from 1920 to 1923 he was assistant mechanical superintendent of the Corbin Screw Corporation. He returned to Winchester in 1923 and remained there until 1934. Mr. Reama has lately been supervising a General Electric training program involving problems in personnel, foremanship, and economics. C. O. DRAYTON has been appointed general



C. O. Drayton, General Sales Manager, American Screw Co.

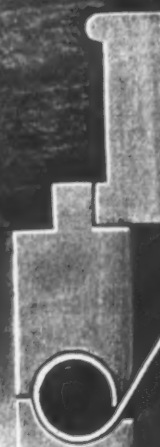
sales manager of the American Screw Co. He was for twelve years previously general sales manager of the Graton & Knight Co.

New Jersey

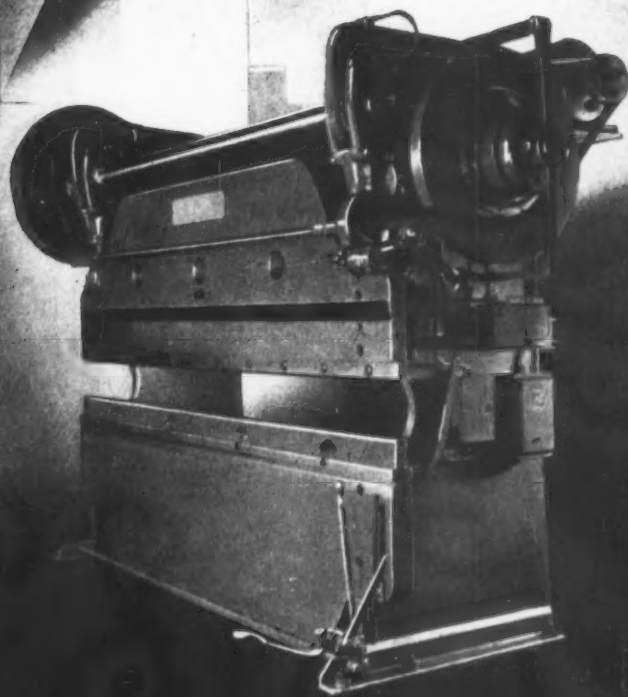
MANNING, MAXWELL & MOORE Co., 446 Communipaw Ave., Jersey City, N. J., has been appointed distributor in the metropolitan New York district for the diemaking machines built by the Oliver Instrument Co., of Adrian, Mich.

THIOKOL CORPORATION, manufacturer of oil-proof synthetic rubber, announces that the general offices and laboratory of the company were moved on April 1 from Yardville, N. J., to 870 N. Clinton Ave., Trenton, N. J.

MAGNUS CHEMICAL Co., Garwood, N. J., has appointed the following sales representatives: Alfred L. Gough in Rhode Island; Jas. J. O'Keefe in Virginia; and Linwood D. Knight in New Hampshire.



Beads straight and true
are closed as accurately in the
center as at the ends on the
Cincinnati All-Steel Press Brake



THE CINCINNATI SHAPER COMPANY

Cincinnati, Ohio

BRAKES ■ SHEARS ■ SHAPERS

New York

A Board of Awards composed of H. L. WHITTEMORE, chairman; G. T. HORTON, and A. G. OEHLER, was recently appointed by the executive committee of the American Welding Society to select the recipient of the Lincoln Gold Medal for 1938, which will be awarded to the author of a paper read before the Society that represents the greatest original contribution to the advancement and use of welding. Further details can be obtained from Warner S. Hays, managing director of the American Welding Society, 33 W. 39th St., New York City.

T. W. HAGER has been appointed vice-president of Peter A. Frasse & Co., Inc., 17 Grand St., New York City, and will act as assistant to the president in the general management of the company. A. B. MEAD, formerly vice-president and manager at the Philadelphia office, has been transferred to the New York office and will assume the duties of vice-president and manager of New York sales. V. HANSEL has been appointed assistant manager of New York sales. J. W. PATRICK, JR., has been made manager of the Philadelphia office, and H. R. ROBSON assistant manager.

CLAYTON S. COGGESHALL has been made general assistant to R. B. BEALE, manager of the turbine division of the central station department of the General Electric Co., Schenectady, N. Y. He was formerly manager of sales in the turbine division of the Lynn River Works. JOHN L. KEER, previously turbine specialist in the central district, has taken Mr. Coggeshall's place at Lynn, and ROBERT S. NEBLETT has become manager of sales of the turbine division in Schenectady.

A. BAIR BASOFF has been appointed general manager of the Atlantic Gear Works, 128 Lafayette St., New York City. RICHARD BEERS has been made works superintendent, and C. DAHLERUP will continue as general superintendent.



J. A. Comstock, Consulting Metallurgist of the Surface Combustion Corporation

with the Illinois Tool Works of Chicago. For several years he was secretary and treasurer of the Chicago Chapter of the American Society for Metals.

GERALD D. HOWK has been appointed mill representative in the Cincinnati territory for the Ludlum Steel Co., Watervliet, N. Y. His headquarters will be in the offices of Julius Uihlein & Co., 208 Elm St., Cincinnati, Ohio. Mr. Howk will assist the Uihlein company in servicing the Ludlum products regularly handled by them. He will also represent the Ludlum Steel Co. on products not now handled by the Uihlein company.

LEE B. GREEN has been appointed general manager of the Steelweld Machinery Co., Cleveland, Ohio, manufacturer of press brakes, bulldozers, crankshaft twisters, and special metal-forming machinery. Mr. Green was general master mechanic of the Timken Roller Bearing Co., Canton, Ohio, for many years, and

subsequently was superintendent of the Lincoln Motor Co., in Detroit, and vice-president and works manager of the Globe Machine & Stamping Co., of Cleveland.

COLUMBIA MACHINE TOOL CO., Hamilton, Ohio, having purchased all the records, drawings, blueprints, and patterns for the punching and shearing machines built by the LONG & ALLSTATTER Co. of Hamilton, is prepared to furnish repairs on these machines and also new improved design plate and structural steel machinery, such as punches, shears, presses, press brakes, etc.

NIAGARA MACHINE & TOOL WORKS, Buffalo, N. Y., has opened a new factory branch office in the Leader Building, Cleveland, Ohio. J. K. FITZGERALD, who has been associated with the company for many years as a sales engineer in the Buffalo territory, will be district sales manager at the new office.



J. K. Fitzgerald, Manager of Cleveland Office of Niagara Machine & Tool Works

Ohio

GERALD KOCHENDERFER, sales manager of the National Tool Co., Cleveland, Ohio, has been elected a director of the company and a member of the executive committee to fill the vacancies caused by the death of E. J. Lees. Mr. Kochenderfer became connected with the National Tool Co. last June. He had previously been associated for seventeen years with the Warner & Swasey Co. of Cleveland, Ohio, for fifteen years of which he was district manager in Chicago.

J. A. COMSTOCK has become consulting metallurgist with the Surface Combustion Corporation of Toledo, Ohio. His duties will consist of the investigation and development of metallurgical processes utilizing furnace atmospheres. During the last four and one-half years Mr. Comstock has been metallurgist



Lee B. Green, General Manager, Steelweld Machinery Co.

RICHARD W. ZIEGLER, 1217 E. Third St., Dayton, Ohio, has been appointed representative in the southern half of the state of Ohio for the R. G. Haskins Co., 4636 W. Fulton St., Chicago, Ill., manufacturer of flexible shaft equipment and tapping machines.

OHIO GEAR Co., Cleveland, Ohio, announces its appointment as exclusive representative in northern Ohio for the line of die-cast V-pulleys, couplings, and variable-speed pulleys made by the CENTRAL DIE CASTING & MFG. Co., Inc., of Chicago, Ill.

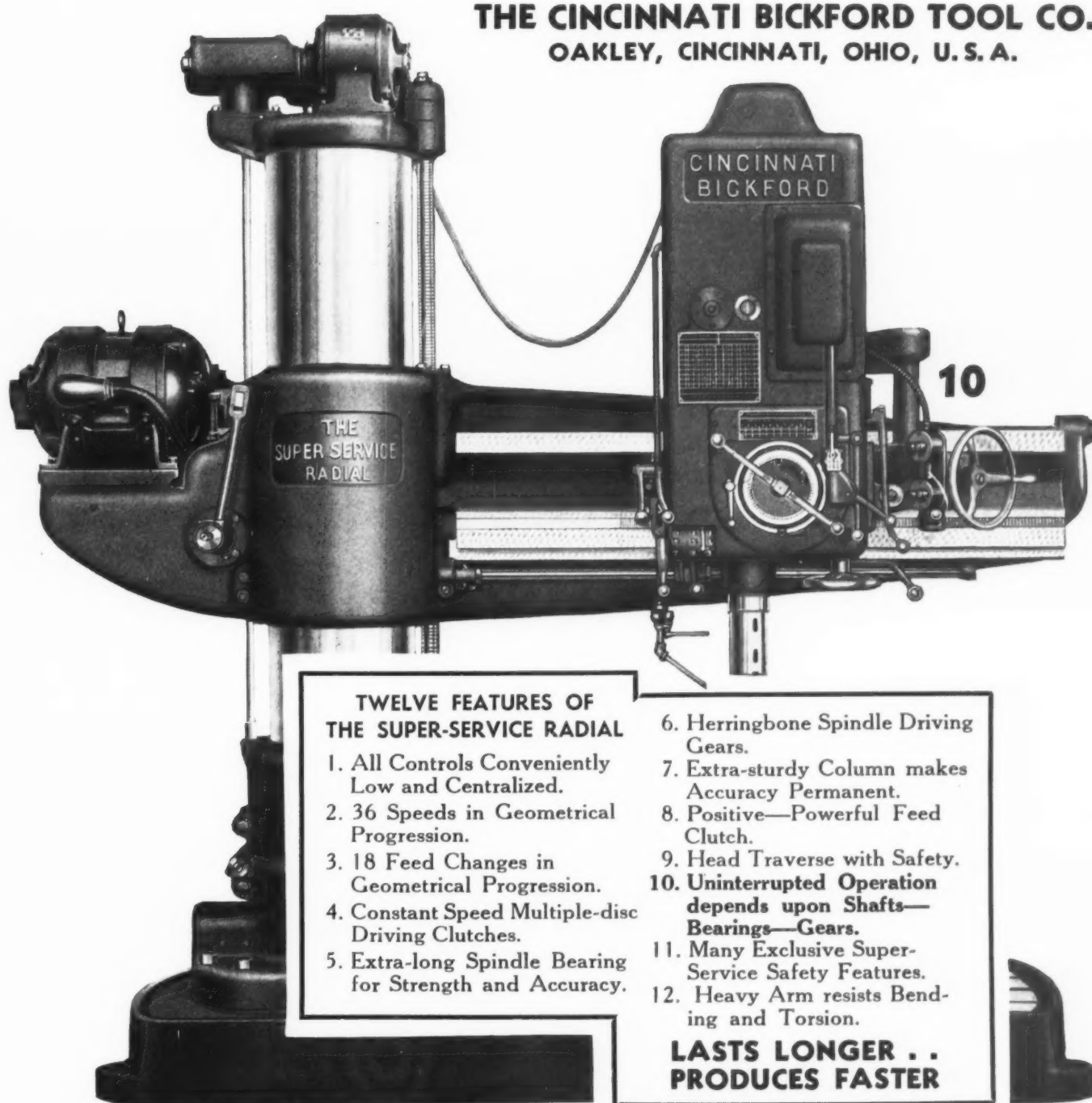
J. A. FAY & EGAN Co., Oakley, Cincinnati, Ohio, which has been operating since January 5, 1937 under the direction of trustees appointed by the Federal Court, has been taken over by a new Ohio corporation and will continue the business under the old name.

Uninterrupted Operation Depends Upon SHAFTS—BEARINGS—GEARS

Uninterrupted operation—economy—profit—in radial drill use depend upon the bearings, shafts and gears. The Super-Service Radial is 100% anti-friction bearing equipped—with all bearings automatically lubricated and sealed against dirt. All gearing is chrome nickel steel, heat treated—the final spindle drive is through herringbone gears. Spiral bevel gears used on the driving clutches, in connection with ground tooth gears in the speed change mechanism, insure quiet

efficiency. Every shaft is multiple splined and the entire mechanism automatically oiled. Thus the maximum percentage of the motor's power is transmitted to the cutting tools—and a full guarantee for maintained smoothness and accuracy is backed by 64 years of metal drilling experience. No expense is spared to make the Super-Service the finest possible radial . . . its numerous exclusive features are fully described and illustrated in bulletin R-24.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY, CINCINNATI, OHIO, U. S. A.



TWELVE FEATURES OF THE SUPER-SERVICE RADIAL

1. All Controls Conveniently Low and Centralized.
2. 36 Speeds in Geometrical Progression.
3. 18 Feed Changes in Geometrical Progression.
4. Constant Speed Multiple-disc Driving Clutches.
5. Extra-long Spindle Bearing for Strength and Accuracy.
6. Herringbone Spindle Driving Gears.
7. Extra-sturdy Column makes Accuracy Permanent.
8. Positive—Powerful Feed Clutch.
9. Head Traverse with Safety.
10. Uninterrupted Operation depends upon Shafts—Bearings—Gears.
11. Many Exclusive Super-Service Safety Features.
12. Heavy Arm resists Bending and Torsion.

**LASTS LONGER . .
PRODUCES FASTER**

Pennsylvania and Maryland

GEORGE H. BUCHER, executive vice-president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been elected president of the company. FRANK A. MERRICK, who has been president since 1929, was elected vice-chairman. Mr. Bucher became connected with the company in 1909 as a member of the graduate students training course, and has steadily advanced up to his present position. Mr. Merrick entered the employ of the Thomson-Houston Electric Co. in 1891. For several years he was with the Canadian Westinghouse Co., Ltd., where he served successively as superintendent, manager, vice-president, general manager, and director. In 1925, he became vice-president and general manager of the Westinghouse Electric & Mfg. Co. at East Pittsburgh, and in 1929 was elected



George H. Bucher, Newly Elected President, Westinghouse Electric & Mfg. Co.

president. C. A. POWEL has been appointed manager of the recently formed industry engineering department of the company. LESLIE M. GUMM has been made manager of the metal-working section of the industrial department. He will have charge of the electrification of automotive plants and steel mills. W. D. TURNBULL is manager of the machinery electrification section of the resale department. JOSEPH SLEPIAN has been appointed an associate director of the Westinghouse Research Laboratories at East Pittsburgh.

SKF INDUSTRIES, INC., Front St. and Erie Ave., Philadelphia, Pa., manufacturer of ball and roller bearings, has started work on an expansion program for the purpose of enlarging its facilities for production and increasing its service to industry. As a part of this program two new wings have been added to the plant and new machinery has been installed. Substantial organization increases have also been made.



Frank A. Merrick, Vice-chairman, Westinghouse Electric & Mfg. Co.

CHARLES BOND CO., 617 Arch St., Philadelphia, Pa., announces the appointment of the following new mid-western stock-carrying distributors for Bond stock gears and speed reducers: S. D. CALLAWAY CO., 1535 Broadway, Kansas City, Mo., and the WARNER HARDWARE CO., 13 S. Sixth St., Minneapolis, Minn.

HENRY BUTLER ALLEN, for many years chief metallurgist of Henry Disston & Sons, Inc., Philadelphia, Pa., was recently awarded the honorary degree of Doctor of Science by Temple University, Philadelphia, Pa., in recognition of the outstanding work that he has done as secretary and director of the Franklin Institute.

LEWIS M. PARSONS has been elected vice-president in charge of sales and a director of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa. He was



Lewis M. Parsons, Vice-president in Charge of Sales of Jones & Laughlin Steel Corporation

previously manager of sales at the Philadelphia office.

MEEHANITE METAL CORPORATION, Pittsburgh, Pa., announces that the following companies have been granted licenses to make castings by the Meehanite process: ATLAS FOUNDRY CO., Detroit, Mich.; GENERAL IRON WORKS DIVISION OF STEARNS-ROGERS MFG. CO., Denver, Colo.; and E. LONG, LTD., Orillia, Ont., Canada. Several other companies have been licensed in Great Britain, France, and Australia.

G. W. PRESSELL, executive vice-president of E. F. Houghton & Co., Third, American, and Somerset Sts., Philadelphia, Pa., has also assumed the position of general sales manager. C. G. SCHULTZE, formerly sales manager of the central division, will be assistant general sales manager. L. D. HOLLAND has been appointed to the newly created position of research sales manager.

BLACK & DECKER MFG. CO., TOWSON, Md., has opened a factory service branch at 630 Baronne St., New Orleans, La.

* * *

Difficulties Due to Too Much Lubrication

In an article in *Esso Oilways*, published by the Standard Oil Co. of New Jersey, D. A. Gibson of that company mentions how trouble was encountered recently with a compressor that had given good service for a number of years. The valves in the high-pressure cylinder carbonized excessively. To remedy the trouble, the amount of oil introduced in the air intake of the cylinder was increased. In less than a week the compressor "froze," due to gum and carbon formations on the cylinder and valves, and a shut-down was necessary.

The compressor was cleaned, the oil feed rate increased further, but in less than a week the compressor again froze. After two more attempts with the same results, a lubrication engineer was called in. Suspecting that an over supply of oil was responsible for the trouble, rather than an under supply, he recommended that the oil feed be reduced to two drops of oil per minute to each cylinder. When this was done, the compressor continued to operate satisfactorily for months.

* * *

Russia Now Exports Machinery

According to the *Economic Survey*, published by the Chamber of Commerce, Moscow, Russia, both the production and exports of Soviet agricultural machinery are increasing steadily. Soviet plants today not only supply the domestic demand for farm equipment, but also export a considerable amount to nearby European countries.

**FASTER SHARPENING
LONGER TOOL LIFE
MORE PRODUCTION**

With an Ex-Cell-O Grinder having diamond wheels and a cooling system, you can sharpen carbide tipped tools *in less than half the time* required with old style dry grinders using vitrified wheels—and, because the tools do not over-heat, the tips do not crack or chip off.

You produce more pieces per grind with tools reconditioned on Ex-Cell-O Grinders. The straight, smooth faces and sharp cutting edges on the tools *turn out more work* and do not fail on the job.

Tool life is increased, because only enough carbide tip material is removed to restore the tool shape. Your tools are used up *in production*, not by grinding.

There are four money-saving Ex-Cell-O Grinder styles, each completely adjustable, for reconditioning straight shank, single point, boring and turning tools. Adaptable for roughing and finishing on right or left hand—round or rectangular cross sections—high speed steel or carbide tipped tools.

EX-CELL-O



CARBIDE



TOOL



GRINDERS

EX-CELL-O

DRILL JIG BUSHINGS. GRINDING SPINDLES. HYDRAULIC POWER UNITS. PRECISION BORING AND FACING MACHINES. PRECISION THREAD GRINDERS. COUNTERBORES. BROACHES. CARBIDE TOOL GRINDERS. CARBOLOY TIPPED TOOLS. SPECIAL HIGH PRODUCTION MACHINES. GROUND FORM TOOLS. PRECISION PARTS. MILLING CUTTERS

EX-CELL-O CORPORATION, 1212 Oakman Blvd., Detroit, Mich.

Please send me, without obligation, your latest catalog on Carbide Tool Grinders (Also, on the products I have checked at the left).

Name..... Title.....

Company.....

Address.....

COMING EVENTS

APRIL 5-8—NATIONAL INVENTORS CONGRESS AND EXHIBITION in Chicago, Ill.; headquarters, Hotel Stevens. Roy C. Burns, managing director, Blum Bldg., Chicago, Ill.

APRIL 19-21—Ninth annual convention of the GREATER NEW YORK SAFETY COUNCIL at the Hotel Astor, New York City. Julien H. Harvey, executive vice-president, Greater New York Safety Council, Inc., 60 E. 42nd St., New York City.

APRIL 25-27—Twenty-second annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION, to be held at General Brock Hotel, Niagara Falls, Canada. J. C. McQuiston, manager-secretary, Penn-Lincoln Hotel, Wilkesburg, Pa.

MAY 4-6—Machine Shop Practice meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Rochester, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 14-19—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago.

JUNE 12-17—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 20-24—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 27-JULY 1—Forty-first annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 260 S. Broad St., Philadelphia, Pa.

JULY 25-29—INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION in Berlin, Germany. Further information may be obtained by addressing the Bureau International de L'Enseignement Technique, 2 Place de la Bourse, Paris (2e), France.

SEPTEMBER 21-23—Sixteenth annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at the Hotel Statler, Cleveland, Ohio. Stanley Knisely, general conference chairman, Republic Steel Corporation, Cleveland, Ohio; Ralph Leavenworth, program committee chairman, Fuller & Smith & Ross, Inc., Cleveland, Ohio. For further in-

formation, communicate with J. A. Martz, 400 W. Madison St., Chicago, Ill.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 17-21—NATIONAL METAL CONGRESS AND EXHIBITION, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 11-19—NATIONAL AUTOMOBILE SHOW at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

DECEMBER 5-10—THIRTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING in the Grand Central Palace, New York City. Further details can be obtained from Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

Anthony J. Hildenbrand

Anthony J. Hildenbrand, purchasing agent for the Cincinnati Milling Machine Co., Cincinnati, Ohio, for nineteen years, died on February 20 at the age of forty-one. Mr. Hildenbrand started in the purchasing department of the com-



Anthony J. Hildenbrand

OBITUARIES

Jacob S. Disston

Jacob S. Disston, son of Henry Disston, the founder of Henry Disston & Sons, Inc., of Philadelphia, died at his southern home in Belair, Fla., on February 28, after an illness of several weeks, at the age of seventy-six. Mr. Disston was made a member of the firm of Henry Disston & Sons in 1888, and served for a number of years as treasurer. He was a member of the board until 1925. He is survived by his widow, two sons, and five daughters.



Jacob S. Disston

pany in 1911, under Philip O. Geier, who is now chairman of the board. He became purchasing agent in 1919 at the age of twenty-three.

During the record-breaking flood of 1937, Mr. Hildenbrand worked unceasingly, setting up, almost overnight, a relief station in the plant for two hundred refugees who had been driven from their homes. He is survived by his widow and one daughter.

PAUL H. DIVER, magnet sales manager with the Ohio Electric Mfg. Co., Cleveland, Ohio, since its organization, died on February 26.

* * *

An Industrial Fish Story

C. W. Yerger, vice-president of the Hanson-Van Winkle-Munning Co., Matawan, N. J., is the authority for the following fish story:

Mr. Fish of the American Steel & Wire Co., Worcester, Mass., recently called on Mr. Pike of the Hanson-Van Winkle-Munning Co., who telephoned Mr. Herring of the company's Pittsburgh office to ask him to arrange an appointment with Mr. Trout of the Bethlehem Steel Co., Johnstown, Pa., so that Mr. Fish would have an opportunity to confer with Mr. Trout.

* * *

A house built entirely of stainless steel will be on display at the 1939 International Exposition in San Francisco.

Announcing—



The New

860

**A REALLY
LOW-COST
GEAR
FINISHER**

- 1. Crossed-axis shaving
- 2. Free cutting—
no burnishing
- 3. No overhanging spindles
- 4. Utmost rigidity
- 5. High flexibility
- 6. Automatic
- 7. Sine-bar lead setting
- 8. Built-in motor, pumps,
tanks, etc.

Designed for application wherever limitations on production quantities, or varieties of gears to be finished do not permit taking advantage of maximum economies possible with the MICHIGAN RACK TYPE FINISHER.

SEND FOR BULLETIN No. 101-61

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS • DETROIT

NEW BOOKS AND PUBLICATIONS

THOMAS' REGISTER OF AMERICAN MANUFACTURERS (1938). 4600 pages, 9 by 14 inches. Published by the Thomas Publishing Co., 461 Eighth Ave., New York City. Price, \$15 (\$10 to old subscribers).

This is the twenty-eighth edition of this well-known comprehensive directory covering American manufacturers in all lines. The present edition follows the same arrangement as previous ones, but the length of the page has been increased to permit the addition of new matter without increasing the thickness of the book. The book has five principal sections, which are printed on different colored paper for ready reference. The first section, covering 184 pages, contains an index to all the products listed in the directory.

The second or main section of the book covers 3548 pages and contains a complete list of manufacturers classified according to business. This list is further subdivided into geographical sections under which the names of the manufacturers are arranged in alphabetical order. The third section contains a list of manufacturers, arranged alphabetically by name, giving home offices, branches, affiliations, succeeding concerns, cable addresses, etc. The fourth section contains a list of leading trade names, brands, etc.; and the fifth section, which comprises an appendix, lists banks, boards of trade and other commercial organizations, and trade papers.

One of the valuable features of this book is the fact that capital or size rat-

ings are given for the firms, so that it is possible to differentiate between small and large concerns. This book has proved to be a valuable aid to purchasing agents, sales managers, and all others who have occasion to make lists of manufacturers for various purposes.

MACHINE TOOLS—TESTING AND INSPECTION. By Pierre Salmon. (Text in French.) 151 pages, 9 1/2 by 12 1/2 inches. Published by Henri Francois, 47-51 Philippe-Auguste Ave., Paris, France. Sold by La Société de Publications Mécaniques, 15 Rue Bleue, Paris. Price, paper-bound, 90 francs; cloth-bound, 110 francs; postage additional.

The aim of this book is to give clear and definite instructions for the testing and inspection of the principal types of machine tools, including engine lathes, turret lathes, automatics, boring machines, planers, shapers, milling machines, drilling machines, grinding machines, gear-cutting machines, presses, and dividing heads. Two classes of tests are included, one a test of the work produced by a machine and the other a test of the machine itself.

The book consists mainly of full-page tables or charts containing diagrams showing the part of the machine to be tested and the application of the testing instruments, as well as such data as the object of the test, the tools to be used in testing, and the allowable tolerances. Two appendixes contain an outline of the general principles to follow in test-

ing machine tools; and information on the tools used in testing, as well as on the tolerances given.

SYSTEMATIC LOCATION OF DIESEL ENGINE TROUBLES. Wall chart, 25 by 38 inches; arranged by Victor W. Pagé. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, 50 cents.

This chart is a valuable guide to the solution of Diesel engine troubles. It is intended especially for shop, school, and garage use. The chart has sectional views of a typical modern light Diesel engine, as well as diagrams of a fuel supply system including the fuel pump, injection pump, and fuel injector. A summary of the various defects that are likely to occur is given, as well as symptoms that indicate the defective condition and remedies for the troubles.

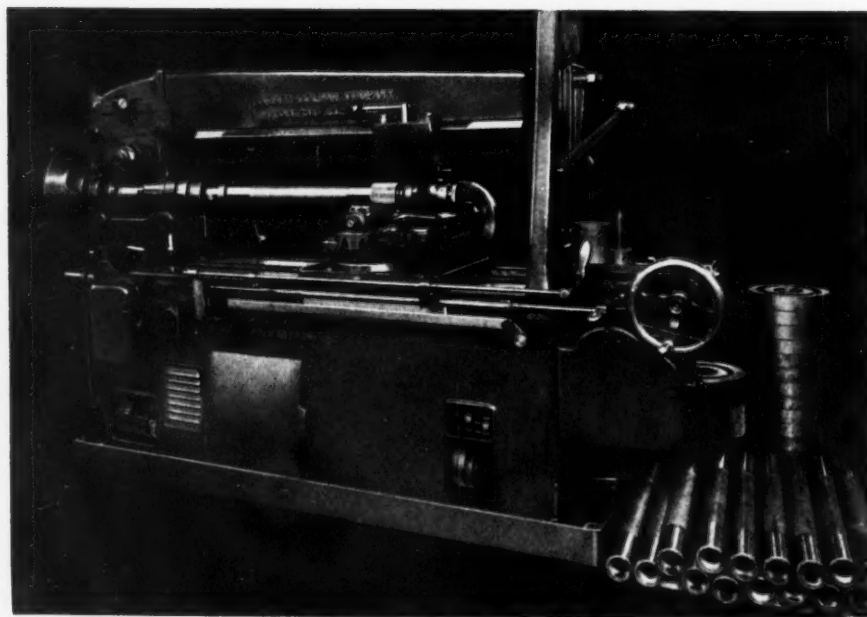
MILLING MACHINE PRACTICE. By Hans Ernst and Mario Martellotti. 16 pages, 5 1/2 by 8 1/4 inches. Distributed free of charge by the Cincinnati Milling Machine Co., Cincinnati, Ohio.

This pamphlet contains a brief resumé of milling machine practice, covering the following subjects: Analysis of process of milling; milling cutters; use of milling cutters; and milling machines.

1937 NATIONAL ELECTRICAL CODE FOR ELECTRIC WIRING AND APPARATUS. 334 pages, 4 by 6 inches. Published by the National Board of Fire Underwriters, 85 John St., New York.

* * *

If anyone has a complete set of **MACHINERY'S Encyclopedia** which he wishes to sell, it is suggested that he communicate with David Cottrell, 806 Long St., Hamilton, Ohio.



Hobbing Serrations on a Blower Rotor Shaft for the Diesel Locomotives Built by the Electro-Motive Corporation, La Grange, Ill., the Operation being Performed on a Barber-Colman Hobbing Machine

HOW ANOTHER MANUFACTURER *Solved a Production Problem* WITH **CONTINENTAL** TOOLS

The Problem

To machine an external gear and a mating internal gear within close limits. The outer gear is $\frac{7}{8}$ " diameter and has 9 teeth with 30° involute form. The inner gear is $\frac{1}{2}$ " diameter and has 7 teeth with the same pitch and form. The finished parts must mate both on the tooth forms and on the top and bottom of the teeth.

The Solution

Mill the external gear with a ground form-relieved cutter designed and built by the Continental Tool Works Division of Ex-Cell-O. Broach the internal gear with roughing and finishing broaches designed and built by Continental. By this method accumulated error on the location of the teeth on both parts is held to a minimum. The mating gears run smoothly, without interference, and make a pressure-tight running fit.

Because Continental makes Broaches and Milling Cutters and Inserted Tooth Cutters and Counterbores and Ground Form Tools and Special Tools, you get complete tooling service. —And, production at lower cost.



EX-CELL-O

DRILL JIG BUSHINGS. GRINDING SPINDLES. HYDRAULIC POWER UNITS. PRECISION BORING AND FACING MACHINES. PRECISION THREAD GRINDERS. COUNTERBORES. BROACHES. CARBIDE TOOL GRINDERS. CARBOLLOY TIPPED TOOLS. SPECIAL HIGH PRODUCTION MACHINES. GROUND FORM TOOLS. PRECISION PARTS. MILLING CUTTERS

EX-CELL-O CORPORATION, 1212 Oakman Blvd., Detroit, Mich.

Please send me, without obligation, your complete catalog on Continental Cutting Tools (Also, on the products I have checked at the left).

Name..... Title.....

Company.....

Address.....

COMING EVENTS

MAY 4-6—Machine Shop Practice meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Rochester, N. Y. Clarence E. Davies, secretary, 29 W. 39th St., New York City.

MAY 14-19—Convention and exhibition of the AMERICAN FOUNDRYMEN'S ASSOCIATION to be held in the Public Auditorium and Lakeside Exhibition Hall, Cleveland, Ohio. Office of the secretary, 222 W. Adams St., Chicago, Ill.

MAY 23-24—Spring meeting of the ASSOCIATED MACHINE TOOL DEALERS OF AMERICA at the Dearborn Inn, Dearborn, Mich. Executive secretary, Thomas A. Fernley, Jr., 505 Arch St., Philadelphia, Pa.

MAY 25-26—Fortieth annual convention of the NATIONAL METAL TRADES ASSOCIATION at the Hotel Biltmore, New York City. Secretary, Harry S. Flynn, Peoples Gas Bldg., Chicago, Ill.

JUNE 12-17—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Greenbrier Hotel, White Sulphur Springs, W. Va. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 20-24—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at St. Louis, Mo. C. E. Davies, secretary, 29 W. 39th St., New York City.

JUNE 24-JULY 2—EIGHTH ANNUAL ECONOMICS CONFERENCE FOR ENGINEERS at the Stevens Engineering Camp, Johnsonburg, N. J. Sponsored by Stevens Institute of Technology, Hoboken, N. J., and the Society for the Advancement of Management.

JUNE 27-JULY 1—Forty-first annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 260 S. Broad St., Philadelphia, Pa.

JULY 25-29—INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION in Berlin, Germany. Further information may be obtained by addressing the Bureau International de L'Enseignement Technique, 2 Place de la Bourse, Paris (2e), France.

SEPTEMBER 21-23—Sixteenth annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at the Hotel Statler, Cleveland, Ohio. Stanley Kniseley, general conference chairman, Republic Steel Corporation, Cleveland, Ohio; Ralph Leavenworth, program committee chairman, Fuller & Smith & Ross, Inc., Cleveland, Ohio. For further information, communicate with J. A. Martz, 400 W. Madison St., Chicago, Ill.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 17-21—NATIONAL METAL CONGRESS AND EXHIBITION, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. Further information can be obtained by communicating with W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 11-19—NATIONAL AUTOMOBILE SHOW at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

DECEMBER 5-10—THIRTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING in the Grand Central Palace, New York City. Further details can be obtained from Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

NEW BOOKS AND PUBLICATIONS

PROCEEDINGS OF THE FORTIETH ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS. Published in two parts. Part I, 1365 pages, 6 by 9 inches. Part II, 707 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Price for each volume, paper-bound, \$5.50; cloth-bound, \$6; half-leather-bound, \$7.

Part I of the Proceedings comprises committee reports and new and revised tentative standards; Part II contains the technical papers. The standards given in Part I cover ferrous metals; non-ferrous metals; ceramic, concrete, and masonry materials; and miscellaneous materials. This part also includes about 118 specifications and tests.

Part II contains forty-seven technical papers, including the Edgar Marburg lecture on "Plastics—Some Applications and Methods of Testing." There are numerous papers relating to metallic materials, including weld metal, and several on cast iron; analysis of the Brinell hardness test; fatigue properties of non-ferrous sheet metals and metals used in aircraft construction; and use of metals at elevated temperatures. The discussions of the papers are included.

GRAPHIC ROUTES TO GREATER PROFITS. By John W. Esterline. 320 pages, 8 1/2 by 11 inches; 450 illustrations. Published by the Esterline-Angus Co., Indianapolis, Ind. Price, \$3.

This is a book on the use of graphic instruments in increasing the productive capacity and the efficiency of industry. It is based on experience rather than theory, 250 case studies being given, each of which covers a distinct problem. The procedure followed, the graphic charts obtained, and the solution reached are given in every case.

The introductory section comprises thirty pages, and is divided into three chapters, under the headings "The High Cost of Inefficiency"; "What Graphical Representation Means"; and "Classifica-

tion of Industrial Problems." The remainder of the book is in five divisions, covering "The Problems of Power"; "The Problems of Machines"; "The Problems of Processes"; "The Problems of Men"; and "Research and Special Problems." The case studies throughout the nineteen chapters are numbered serially, and are carefully cross-indexed.

AIRPLANE SERVICING MANUAL. By Victor W. Pagé. 1000 pages, 6 by 9 inches; 500 illustrations. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, \$6.

This airplane servicing manual covers the inspection, maintenance, rigging, engine work, and repair of all types of airplanes. It is intended for students, pilots, airplane and engine mechanics, commercial operators, and field service men. The author is an authority on the subject, with many years of practical experience in the servicing of planes. The book outlines all the tools and machines, supplies, and mechanical processes incident to servicing modern airplanes, including comprehensive instructions for welding, heat-treatment, and manipulation of all the important materials of construction. It should be of especial value to instructors wishing to obtain an easily understood work on the latest aeronautical mechanical practice.

RESISTANCE TO HEAT CHECKING OF CHILLED IRON CAR WHEELS AND STRAINS DEVELOPED UNDER LONG CONTINUED APPLICATIONS OF BRAKE SHOES. By Edward C. Schmidt and Herman J. Schrader. 52 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 298 of the Engineering Experiment Station. Price, 55 cents.

THE INFLUENCE OF DESIGN ON THE STRESS RESISTANCE OF STEEL CASTINGS. By R. A. Bull. 62 pages, 6 by 9 inches. Published by the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. Price, 35 cents.

SHOP EQUIPMENT SECTION

marking on steel, iron, aluminum, brass, bronze, glass, wood, Bakelite, and many other materials, has been brought out by the Carron Mfg. Co., 415 S. Aberdeen St., Chicago, Ill., and is being sold by the Walls Sales Corporation, 96 Warren St., New York City. It is claimed that the marking of dies and tools and the engraving of gold and silver with this tool is as simple as writing with a pencil. The tool can be furnished ready to plug into any alternating-current outlet. 82

Shakespeare Automatic Buffing Machine

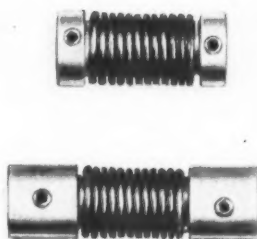
An automatic buffing machine that feeds the work straight into the buffing wheel with an equal pressure on all important surfaces has been brought out by the Shakespeare Products Co., 417-427 N. Pitcher St., Kalamazoo, Mich. This machine is particularly adapted for the contour buffing of soft metals and plastic materials, as well as for hard buffing of steel and brass parts. It was originally developed for



Automatic Buffing Machine Made by the Shakespeare Products Co.

use in the company's own buffing room, where similar machines have been employed on a three-shift basis for the past year.

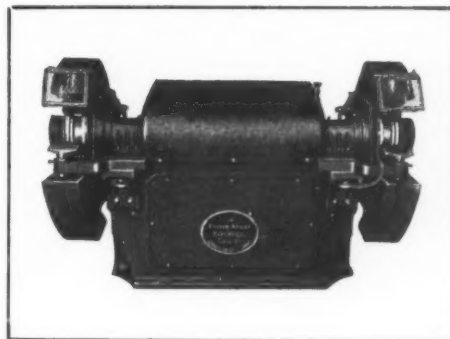
A large variety of parts can be handled on this machine without additional expense for tool equipment. Only fifteen minutes or less is required to set up the machine for buffing a new part, and many salvage and small-run jobs that could not be hand-buffed economically can be buffed automatically on this machine on a profitable basis. 83



Couplings Made by Specialty Sales & Service Corporation

Flexible Couplings for Small Shafts

The Specialty Sales & Service Corporation, 138 Holden St., Minneapolis, Minn., has brought out a flexible coupling of the design illustrated, which is made in lengths of from 2 to 5 inches for shafts ranging from 5/16 to 1/2 inch in diameter. These SSS flexible couplings are designed especially for connecting the shafts of oil-burner motors to pumps or fans. The torsional spring picks up the load from the motor when starting and regulates the driving force as the pump or fan gains speed. The extension end sections of the coupling are made of solid steel and are cadmium-plated. They are cross-drilled and tapped to receive set-screws for clamping the shafts in place. 84



Grinder Brought out by the United States Electrical Tool Co.

Grinder Designed to Maintain Constant Surface Speed

A grinder equipped with a variable-speed drive to permit maintaining a constant surface grinding speed regardless of the wheel diameter has been added to the line of grinders made by the United States Electrical Tool Co., Cincinnati, Ohio. This grinder has a constant speed, totally enclosed ball-bearing, fan-cooled motor, mounted on a hinged platform to provide for belt adjustment; heavy wheel flanges keyed to the spindle; adjustable weights mounted in grooves for balancing the grinding wheels; boiler-plate wheel guards which are adjustable for wheel wear; permanent exhaust connections; safety eye-shields, mounted on guards; and a variable-speed transmission which is interlocked with the wheel guards to prevent overspeeding. 85

Double-Duty Transformer for Operating Two Mercury Lamps

A transformer known as "Tu-Lamp," which is designed to operate two 400-watt Type H mercury lamps at peak efficiency has just been introduced by the General Electric Vapor Lamp Co., 893 Adams St., Hoboken, N. J. The new unit is intended to supplement the standard line of transformers for mercury lamps made by this company. Use of the double-duty unit per-

SHOP EQUIPMENT SECTION

mits a reduction of 20 per cent in transformer costs and reduces installation costs. The transformer losses are reduced 30 per cent, as compared with two single-lamp units.

With this new unit, one lamp starts and reaches its full efficiency before the other. One lamp will continue to burn with as much as a 40-volt drop in the circuit. Should one of the lamps burn out, the other will operate normally without injury to the transformer. 86

Palmgren Safety Chuck

A chuck that permits drills of various sizes to be changed quickly and safely while the machine spindle is running at full speed and that requires no keys, wrenches, or pins for its operation has been added to the line of Palmgren tools made by the Chicago Tool & Engineering Co., 8389 S. Chicago Ave., Chicago, Ill. This chuck is designed for use on drill presses, lathes, milling machines, turret lathes, elec-

tric drills, air drills, flexible shafts, and also polishing and lapping machines. It grips the drill automatically, yet releases it instantly when the outside sleeve is held and pulled down slightly.

This chuck is made in three sizes having drill capacities of 3/16, 1/4, and 3/8 inch. All sizes are accurately balanced, and made with interchangeable hardened and ground parts. 87



Palmgren Safety Drill Chuck

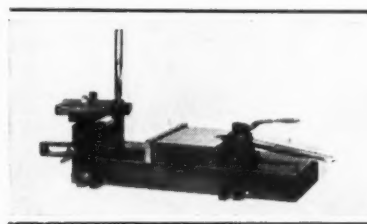


"Master" Disk Grinder

"Master" Electrically Driven Disk Grinder

A disk grinder designated the "Master," which is made in three sizes having disks 18, 20, and 24 inches in diameter, has been brought out by the Kindt-Collins Co., 12697 Elmwood Ave., Cleveland, Ohio. The motor is push-button controlled. The three sizes have shaft speeds of 1850, 1660, and 1450 revolutions per minute when used for wood grinding, and 1550, 1500, and 1350 revolutions per minute when used for metal.

The table can be tilted down 45 degrees and up 25 degrees by means of a worm and gear device. Dust is removed by a suction fan in the base which is driven by V-belts. 88



Miller & Crowningshield All-steel Vise with Drill Jig Attachment

Miller & Crowningshield All-Steel Vise

A cam-operated, quick-acting vise designed to combine good gripping power with light weight has been developed by Miller & Crowningshield, Greenfield, Mass. The 9-inch size vise has a jaw depth of 2 inches, opens 10 1/2 inches, and weighs 60 pounds. It can be provided with a larger opening if desired. The vise can also be supplied with or without the drill jig attachment shown and with various modifications in design. 89

Idilite and Idilon Polishing Abrasives

The M. P. Iding Disc Grinding Compound Co., Inc., 3534 W. Pierce St., Milwaukee, Wis., has recently introduced on the market two new polishing abrasives known as "Idilite" and "Idilon," in which this company's original polishing cements are used. These abrasives have been developed as a result of extensive research carried on by the company in conjunction with one of the largest manufacturers of abrasives, who is now manufacturing the new products.

Idilite, an aluminum-oxide abrasive, is manufactured in two types—the ET type or etched-grain abrasive possessing very high capillarity and exceptionally sharp-cutting qualities, and the NT type or non-etched-grain abrasive which possesses long wearing qualities and has been found to give bright finishes when used with cements. The Idilon silicon-carbide abrasive is particularly adapted for polishing gray iron of all kinds. 90

Meeting of Metal Trades Association

The fortieth annual meeting of the National Metal Trades Association was held at the Biltmore Hotel, New York City, May 25 and 26. Among the papers presented were the following: "More Stable Employment and Economy," by W. E. Odom, William Odom Associates, Chicago, Ill.; "An Appraisal of Factors in the Labor Relations Situation," by Harold F. Browne, director of Industrial Management Division, National Industrial Conference Board, New York City; "Employee Meetings with Management," by C. S. Craigmile, vice-president, Belden Mfg. Co., Chicago, Ill.; "How We Handle Our Employees," by C. C. Winegardner, vice-president, Diamond Chain & Mfg. Co., Indianapolis, Ind.; "Legal Aspects of Labor Relations," by David R. Clarke, Fyffe & Clarke, Chicago, Ill.; "Restoring the Control of Wages and Working Hours to Management," by Allen W. Rucker, president, Eddy-Rucker-Nickels Co., Cambridge, Mass.; "Job Evaluation," by O. D. Reich, vice-president, Dexter Folder Co., Pearl River, N. Y.; and "What the CIO Has Done to Michigan," by Hon. Clare E. Hoffman, Congressman from Michigan.

The president of the Association, Charles H. Strawbridge, gave a very complete report of the Association activities during the past year. The meeting was unusually well attended.

The Dumore Co. Celebrates Twenty-Fifth Anniversary

The Dumore Co., Racine, Wis., manufacturer of fractional-horsepower universal motors and portable electric tools for precision grinding, celebrates its twenty-fifth anniversary



L. H. Hamilton, President and One of the Founders of the Dumore Co., Racine, Wis.

the Dumore Co. in order to make the corporate name conform to that of the company's widely known products. Previous to the founding of the Wisconsin Electric Co., the two founders had been associated in the Hamilton Beach Mfg. Co., started in 1910, which pioneered some of the most widely used electrical appliances today—vacuum cleaners, vibrators, and hair driers. Both of these men had formerly been employed by the Arnold Electric Co. of Racine, Wis.

The Wisconsin Electric Co., founded in 1913, the forerunner of the Dumore Co., at first manufactured sewing machine motors and vacuum cleaners. The company also introduced the first electric wax polisher. Its reputation for building precision tools and fractional-horsepower universal motors has steadily increased, and today the Dumore Co. supplies standard and specially built universal motors to many widely known appliance manufacturers. The company now occupies comparatively new quarters having, in 1934, purchased and equipped a large and fully modern factory building.

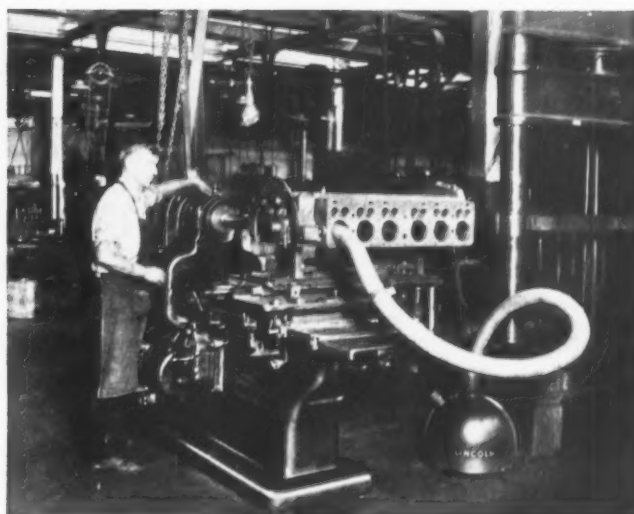
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sary this year. It was in 1913 that L. H. Hamilton, president of the Dumore Co., and the late Chester Beach founded the Wisconsin Electric Co., which in 1929, changed its name to

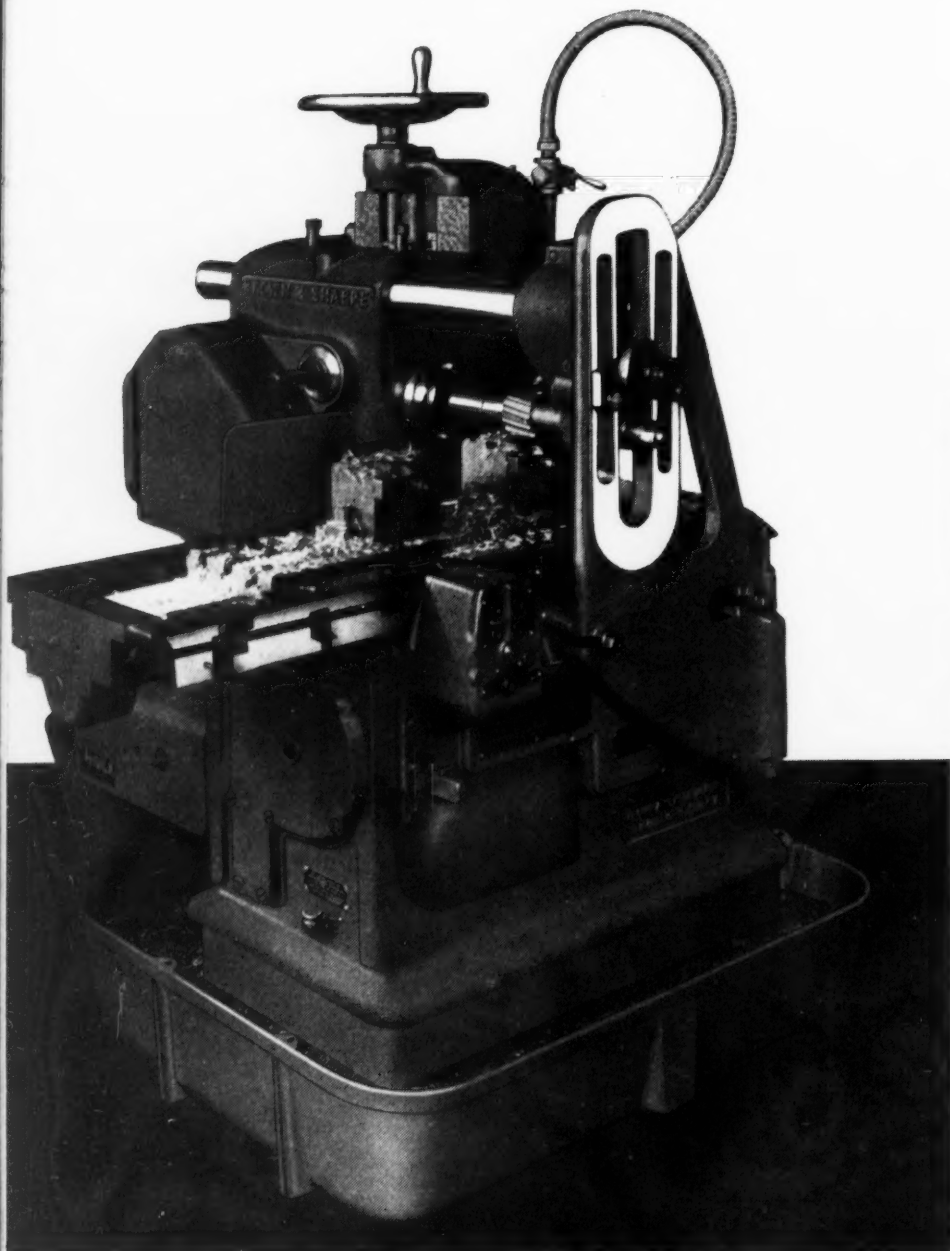
The peripheral speed of recent large turbine rotors is approximately 820 miles per hour, about equal to the speed of sound.



Air Cleaner for Use in Grinding, Welding, and Other Operations, Recently Placed on the Market by the Lincoln Electric Co., Cleveland, Ohio. At the Left This Equipment is Shown being Used for Drawing Smoke and Particles of Dirt away from a Copper



Welding Operation. In the Illustration at the Right the "Linconditioner," as the Equipment is Termed, is Shown being Used for Removing the Dust Produced in Performing a Grinding Operation on Engine Cylinder Blocks



PRODUCTIVE MACHINE TOOLS

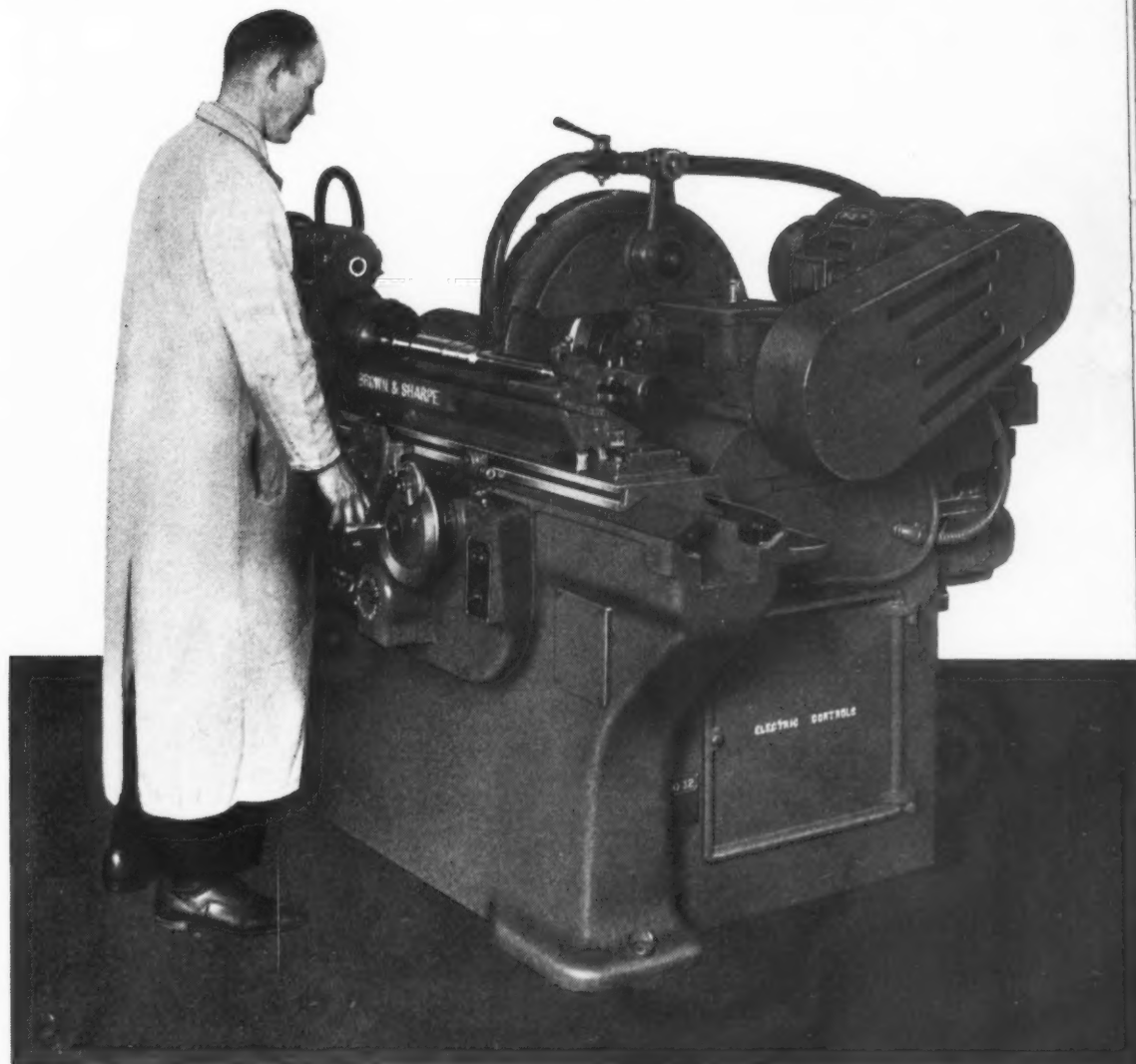
Left - No. 12 Plain Milling Machine . . a high production manufacturing type . . electrically controlled.

Many new features of design and construction are offered in the Brown & Sharpe line . . . features that justify replacement of equipment less productive than the new designs **now available** for lowering manufacturing costs.

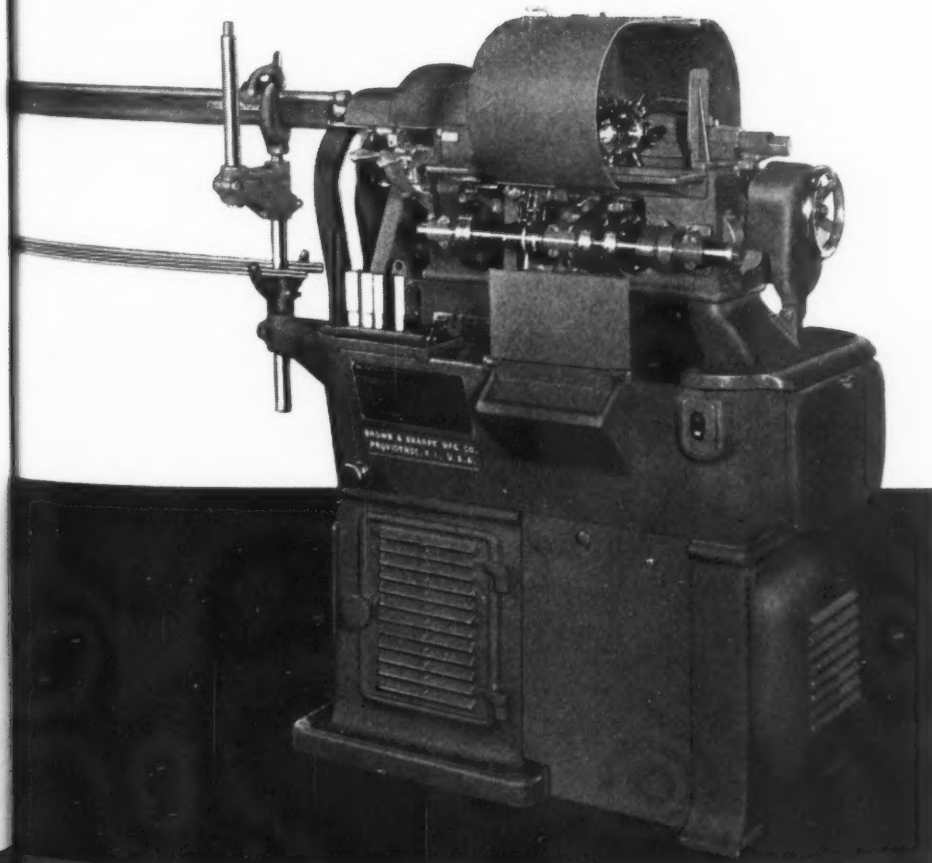
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BROWN &

**Right - The new No. 12
Plain Grinding Machine
.. Electric-Hydraulic
Type for small and
medium size work.**



**Left - The Latest in Automa-
tic Screw Machines .. No. 00G
.. that will give surprisingly
high production rates.**



Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

SHARPE

NEWS OF THE INDUSTRY

California

MACHINERY SALES Co., 4439 Sante Fe Ave., Los Angeles, Calif., has been organized to take over the HERBERTS MACHINERY Co., Los Angeles, Calif. Mr. Herberts has gone into the manufacture of aircraft parts in a corporation known as the Herberts Engineering Corporation, which has no connection with the machine tool business. The many agencies formerly controlled by the Herberts Machinery Co. for southern California and Arizona have affiliated themselves with the new concern, which will also operate in the same territory. The president of the new company is D. N. MACCONEL, who has been associated with the Herberts Machinery Co. for fourteen years, the last seven of which as vice-president and sales manager. S. W. CLAWSON, secretary of the former company for sixteen years, will hold the same position with the new organization, and N. TROOP, who has been with the Herberts Machinery Co. for eighteen years, the last ten of which as treasurer, will serve as treasurer of the Machinery Sales Co.

INDEPENDENT PNEUMATIC TOOL Co., 600 W. Jackson Blvd., Chicago, Ill., announces the opening of a new sales-service branch at 6200 E. Slauson Ave., Los Angeles, Calif., with B. J. HERRON in charge.

Connecticut

WILLIAM A. PURTELL, president of the Holo-Krome Screw Corporation, Hartford, Conn., and president-treasurer of the Billings & Spencer Co., also of Hartford, was elected president of the American Supply and Machinery Manufacturers' Association at the joint annual convention of the National Supply and Machinery Distributors' Association, the Southern Supply and Machinery Distributors' Association, and the American Supply and Machinery Manufacturers' Association, held at Pittsburgh, Pa., in May.

WALTER M. NONES was re-elected president of the Norma-Hoffmann Bearings Corporation, Stamford, Conn., at a recent meeting of the board of directors. ODBERT P. WILSON was elected executive vice-president and treasurer. This action delegates to Mr. Wilson, who has been associated with the company for twenty-four years, the executive duties and responsibilities that were carried for twenty-seven years by Mr. Nones. HAROLD J. RITTER was re-elected secretary of the company.

D. E. BATESOLE, formerly assistant chief engineer of the Norma-Hoffmann Bearings Corporation, Stamford, Conn., has been advanced to the position of chief engineer, succeeding the late George R. Bott. T. E. ROUNDS of the engineering department has been made assistant chief engineer.

STANLEY ELECTRIC TOOL DIVISION, STANLEY WORKS, New Britain, Conn., has appointed the OLIVER H. VAN HORN Co., Inc., New Orleans, La., distributor for its line of electric tools in the South.

JAMES COULTER MACHINE Co., manufacturer of special automatic machinery, shaping planers, vertical and horizontal profilers, and precision boring machines, moved into its new plant at 386-404 Mountain Grove St., Bridgeport, Conn., on May 1.

Massachusetts

WARREN PULLEY COVER Co., 15 Union St., Lawrence, Mass., manufacturer of the Warren pulley cover, designed to minimize belt slippage, has appointed the FEDERATED SALES SERVICE, INC., 729 Boylston St., Boston, Mass., marketing counsel for the company, to assist in all matters pertaining to sales and advertising, and to organize and supervise a national sales force of manufacturers' agents for selling the company's pulley cover to the industrial trade.

MILTON P. HIGGINS has been appointed resident manager of the Chippawa, Ontario, Canada, electric furnace plant of the Norton Co., Worcester, Mass., to take the place of the late John B. Glaze. Mr. Higgins has been with the company for about ten years, and has had experience in both sales and production. He was previously manager of sales research, and is a member of the board of directors of the company.

F. A. PARKER, 20 Fern St., Auburn-dale, Mass., has been appointed representative of the MICROMATIC HONE CORPORATION and the BARNES DRILL Co. in the New England territory, formerly handled by the late Arthur S. Pierce, of Melrose, Mass.

PANGBORN CORPORATION, Hagerstown, Md., has removed its New England offices to 175 State St., Springfield, Mass. J. H. CONNOLLY, who has previously been connected with the company's Detroit office, will be in charge of the Springfield office.

A. MILNE & Co., whose offices have been located at 141 Milk St., Boston, Mass., for fifty-one years, moved on May 1 to 109-111 Broad St., Boston, where offices, as well as a tool and drill steel warehouse, have been established.

Michigan and Illinois

WILLIAM E. BEE, president since its founding in 1905, of the Palmer-Bee Co., Detroit, Mich., manufacturer of power transmission and materials-handling machinery, has been made chairman of the board. GEORGE A. BEE becomes president and general manager. J. E. McBRIDE remains vice-president. A. G. LECKIE is treasurer, and D. N. SWEENEY, secretary.

R. J. SCHULER, formerly general manager of sales of the LaSalle Steel Co., Chicago, Ill., has joined the Republic Steel Corporation, Cleveland, Ohio, in the capacity of general sales representative of the Union Drawn Steel Division at Massillon, Ohio. For the present, Mr. Schuler will make his headquarters at the Detroit offices.

FANSTEEL METALLURGICAL CORPORATION, North Chicago, Ill., has appointed the MICHIGAN TOOL Co., Detroit, Mich., sales representative for Tantaloy hard-cutting metal and Tantaloy-tipped tools.

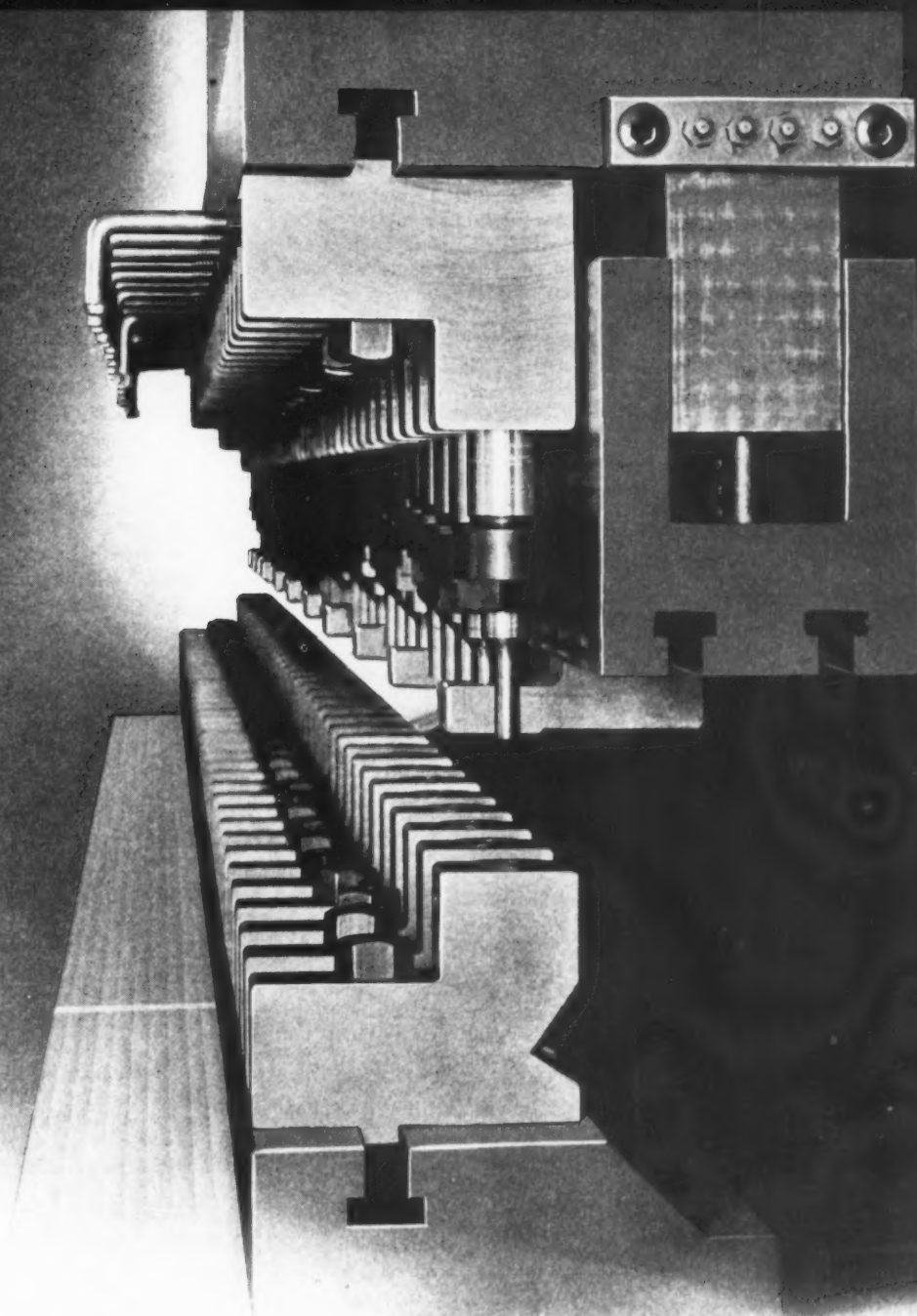
GEORGE M. MENCKE, formerly with Thomas Prosser & Son and later with the Carboly Company, Inc., of New York, is now sales manager of the Vascoloy-Ramet Corporation, North Chicago, Ill. JAMES A. FRASER, previously with the Vanadium-Alloys Steel Co., at North Chicago, Ill., has been made assistant sales manager.

J. B. WITTRUP, for twenty-three years connected with the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., has been appointed manager of the Chicago Mechanical Rubber Goods Branch.

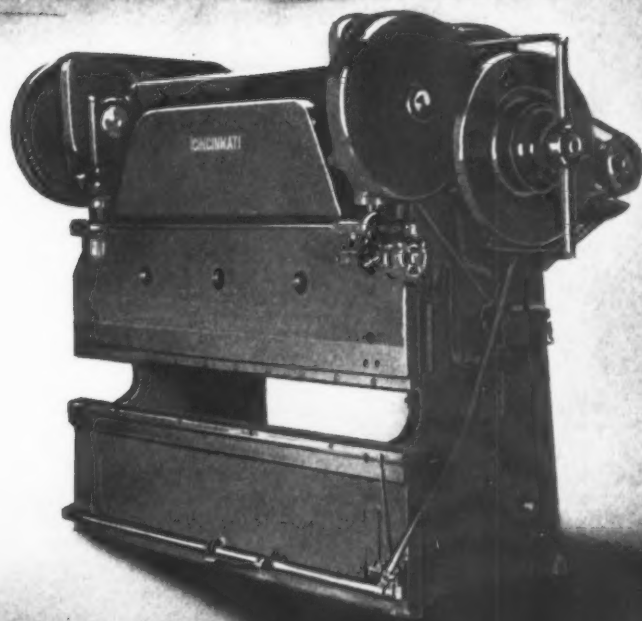
New York

RUSSELL, BURDSALL & WARD BOLT & NUT Co., Port Chester, N. Y., has been licensed by the AMERICAN SCREW Co., Providence, R. I., to use the Phillips recessed head on its line of Empire machine screws, stove bolts, and sheet-metal screws. The recessed-head screw has the advantage of saving time in assembly by fitting the driver and requiring only one hand for operation, by guarding work against slippage of the driver, and by permitting tighter fastening with greater holding power.

J. N. GOODIER has been appointed acting professor of mechanics in the Sibley School of Mechanical Engineering at Cornell University. Dr. Goodier, who



The refinements of Cincinnati Press Brakes provide the same efficiency for multiple punching as for forming sheet metal . . .



THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS • SHEARS • BRAKES

holds degrees from Cambridge University in England and from the University of Michigan, is widely known for his research in elasticity, plasticity, and advanced dynamics. He comes to Cornell from the Ontario Research Foundation, where he has been research fellow in applied mechanics since 1931.

A. C. DANEKIND, chairman of the factory equipment and practice committee of the General Electric Co., Schenectady, N. Y., has been made assistant to vice-president N. R. Birge, with offices in Schenectady. In his new position, Mr.



A. C. Danekind, Newly Appointed Assistant to Vice-president of General Electric Co.

Danekind will work with companies affiliated with the General Electric Co. As a member of the staff of the General Electric manufacturing general department, he has been primarily interested in machine tools and processing. In this connection, he is well known in the machine tool industry, having served as president and chairman of the Machine Tool Congress.

R. C. VAUGHN has been appointed sales engineer of the Harnischfeger Corporation, Milwaukee, Wis., manufacturer of overhead traveling cranes. He will make his headquarters at the company's New York offices, 350 Fifth Ave. Mr. Vaughn has had over twenty years of experience in the sale of electric hoists and overhead traveling cranes in the New York area.

W. Z. FRIEND, of the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York City, recently addressed the West Virginia Section of the American Society of Mechanical Engineers on the subject of "The Properties and Applications of Nickel and Its Non-Ferrous Alloys."

WHITEHEAD METAL PRODUCTS CO., a subsidiary of the INTERNATIONAL NICKEL

Co., has opened a new warehouse and assembly plant at 287-303 W. 10th St., New York City. The company has been located for the last eleven years at 304 Hudson St.

GENERAL ELECTRIC Co., Schenectady, N. Y., at a meeting of the board of directors in April, re-elected OWEN D. YOUNG, chairman of the board, and GERARD SWOPE, president of the company. All the other officers were also re-elected.

Ohio

HYDRAULIC PRESS MFG. Co., Mount Gilead, Ohio, has on exhibition at the Franklin Institute, Philadelphia, Pa., one of its new injection molding presses, displayed in conjunction with an exhibit of molded plastics sponsored by the Institute. The molding press is in actual operation, molding a medallion commemorating the dedication of the Franklin Memorial, which took place on May 19. The exhibit opened about the middle of April and will continue for about three months.

WILLIAM P. ANDREWS, formerly assistant manager of sales in the Chicago district of the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa., has been appointed manager of sales in the Cincinnati district to fill the position made vacant by the death of Lawrence K. Slaback. T. LANE WATSON will take Mr. Andrews' place as assistant manager of sales in the Chicago district.

UNION METAL MFG. Co., Canton, Ohio, recently purchased the BURTON MFG. Co., formerly at Michigan City, Ind., manufacturer of seamless steel structural tubing, and has moved the business to Canton. E. B. ROGERS, president of the Burton Mfg. Co., is in charge of tubing operations with the Union Metal Mfg. Co.

CIMATOOL Co., Dayton, Ohio, manufacturer of machine tools, dies, tools, and fixtures, recently moved into a new plant of steel and concrete construction, 100 by 300 feet, on Springfield St. in Dayton.

RELIANCE ELECTRIC & ENGINEERING Co., Cleveland, Ohio, has moved its New York office to 110 E. 42nd St. The Pittsburgh office has been moved to 355 Fifth Ave.

Pennsylvania

W. ROY WIDDOES has been appointed general manager of the By-Products Steel Corporation, Coatesville, Pa. Mr. Widdoes was previously connected with the Lukens Steel Co. as assistant purchasing agent. In May, 1937, he joined

the By-Products Steel Corporation as assistant to the president, R. W. Moffett, and served in that capacity until his recent appointment as general manager.

BETHLEHEM STEEL Co., Bethlehem, Pa., announces that it has entered the seamless tubing business and that it is now in a position to supply seamless casing, tubing, and line pipe, thus rounding out its line of products for the oil industry. All standard sizes and types will be made.

HARRY F. BOZ has been appointed manager of the service department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., succeeding W. K. DUNLAP, who is retiring after forty-six years of service.

WILLIAM ARTHUR has been appointed Philadelphia district office manager of the Allis-Chalmers Mfg. Co., Milwaukee, Wis., to succeed the late J. E. Wray.

* * *

"Let Me Tell You About Machine Tools"

Copies of a booklet entitled "Let Me Tell You About Machine Tools" can be obtained from the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland, Ohio. This booklet is written by a machine operator who tells what machine tools are, what they do, and something about the men who operate them. The booklet is interestingly illustrated, and contains information about the machine tool industry that will prove informative to all who do not fully understand what machine tools are and what they have done for the world—how they have raised wages, shortened hours, increased living standards, and improved the opportunities for employment in the most varied fields of endeavor.

* * *

Westinghouse Awards Research Fellowships

The first five Westinghouse research fellowships for work in fundamental science at the Westinghouse Research Laboratories in East Pittsburgh, have been awarded to the following men, who were chosen from a group of fifty: Robert O. Haxby of the University of Minnesota; John A. Hipple of Princeton University; Sidney Siegel of Columbia University; W. E. Shoupp of the University of Illinois; and W. E. Stephens of the California Institute of Technology.

The five appointments are the first to be made under a plan announced last December, whereby the Westinghouse Electric & Mfg. Co. plans to support the work of ten young physicists on fundamental studies broadly related to the electrical industry. The fellows are appointed for one year and are eligible for one reappointment.

SPEED

The Super-Service is designed to deliver a constant and unvaried horsepower throughout this entire range of 36 speeds—from 26 R.P.M. to 1572 R.P.M., for example. An optional range of speeds can be supplied to suit your work. Bulletin R-24 for complete details.

Speeds on a radial drill should be controlled at the head. This requires a simple and compact gear train. The Super-Service provides just that: A simple, compact gear train consisting of only seventeen gears. All gears are of alloy steel. High speed gears have ground teeth. Shafts are short, sturdy, of alloy steel—multiple splined and supported by Timken Bearings. This Super-Service Gear train, located in the head—controlled at the head—delivers 36 selective, sliding gear changes with a 60-to-1 range. These thirty-six speeds are carefully graded in a precise geometrical progression and no speeds are lost through duplication or overlapping.



**THE CINCINNATI
BICKFORD TOOL
COMPANY**
OAKLEY, CINCINNATI, OHIO

OBITUARIES

Forrest E. Cardullo

Forrest E. Cardullo, chief engineer of the G. A. Gray Co., Cincinnati, Ohio, died of heart trouble on May 7 at his home in Cincinnati, aged fifty-eight years. Mr. Cardullo had been ill for several years. He was born in Buffalo, N. Y., November 20, 1879. He received his engineering education at Cornell



© Bachrach

Forrest E. Cardullo

University, from which he graduated in 1901 with the degree of M.E. Until 1905 he was engaged in commercial work in the design of heavy gas engines and steam pumping engines. From 1905 to 1908 he was an instructor and assistant professor of mechanical engineering subjects at Syracuse University. From 1908 to 1914 he was professor of mechanical engineering at New Hampshire State College. The following year he became chief draftsman of the Pierce-Arrow Motor Car Co., leaving that concern to become engineer of tests with the Curtiss Aeroplane & Motor Corp.

Mr. Cardullo was the author of a textbook, "Thermo Dynamics," used in a number of colleges in this country and abroad. He also wrote articles for the technical press, and a number of years ago was a frequent contributor to MACHINERY.

Mr. Cardullo accepted the position of chief engineer of the G. A. Gray Co. July 1, 1919, and held that position continuously up to the time of his death. He was the inventor of a great many improvements in machine tools, one of the most noteworthy being a new system of helical involute gearing for planers.

Mr. Cardullo was a member of the American Society of Mechanical Engineers, and at the time of his death was junior past-chairman of the local chapter and a member of the executive committee. He was also active in the affairs of the Engineers Club of Cincinnati.

Those who knew Mr. Cardullo respected him for his brilliant mind, and his great store of knowledge not only of engineering and scientific subjects, but also of music, art, literature, current events, and political economy. He was beloved by his business associates and by a wide circle of friends. Although he was a busy man, he always found time to help those who were in trouble.

FRED J. BARTLETT, of the Industrial Electric & Machine Co., High Point, N. C., died at his home in High Point on March 4. Mr. Bartlett had been connected at different times with the Western Electric Co., the Midwest Electric Co. of Omaha, Neb., the Boston office of the Westinghouse Electric & Mfg. Co., and the Electric Machinery Co. of Minneapolis, as manager of the Boston office. In 1921, he went to High Point, N. C., and organized the Industrial Electric & Machinery Co., of which he was owner and manager at the time of his death.

CHARLES H. SHAW, for the last three years Philadelphia office manager of the Worthington Pump & Machinery Corporation, Harrison, N. J., died at his home in Philadelphia on April 15. Mr. Shaw was born in Owensboro, Ky., in 1898, and graduated from Syracuse University in 1919. He became associated with the Worthington organization in 1920, and was manager of the Pittsburgh office from 1928 to 1935, when he was transferred to Philadelphia.

SILAS A. TUCKER, of Evanston, Ill., manager of the Chicago Mechanical Rubber Goods Branch of Raybestos-Manhattan, Inc., Passaic, N. J., died on April 14 in the Presbyterian Hospital in Chicago. Mr. Tucker was fifty-one years of age. He had been with the company more than twenty-five years, and for many years had been manager of the Chicago branch. He was an alumnus of the University of Chicago.

* * *

Old Employes Honored

The Manufacturers' Association of Hartford County, Hartford, Conn., gave a dinner on April 28 at the Hartford Club for all employes of the various manufacturers in Hartford County who had been connected with the same company for forty years or more. Governor Cross of Connecticut was the principal speaker. Over 600 employes and executives from the different companies were present. Two of the men had worked for the same firm over seventy years. Twenty employes of the Peck, Stow & Wilcox Co., Southington, Conn., attended, with service records ranging from forty-one to sixty-nine years.

COMING EVENTS

JUNE 6-9—ELEVENTH NATIONAL OIL AND GAS POWER MEETING of the Oil and Gas Power Division of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Baker Hotel, Dallas, Tex. Edgar J. Kates, chairman, 415 Lexington Ave., New York City.

JULY 25-29—INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION in Berlin, Germany. Further information may be obtained by addressing the Bureau International de L'Enseignement Technique, 2 Place de la Bourse, Paris (2e), France.

SEPTEMBER 19-23—SEVENTH INTERNATIONAL MANAGEMENT CONGRESS at Washington, D. C. Executive secretary, Nathaniel W. Barnes, Room 1201, 347 Madison Ave., New York City.

SEPTEMBER 21-23—Sixteenth annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at the Hotel Statler, Cleveland, Ohio. Stanley Knisely, general conference chairman, Republic Steel Corporation, Cleveland, Ohio; Ralph Leavenworth, program committee chairman, Fuller & Smith & Ross, Inc., Cleveland, Ohio. For further information, communicate with J. A. Martz, 400 W. Madison St., Chicago, Ill.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 13-15—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Ambassador Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 17-21—NATIONAL METAL CONGRESS AND EXHIBITION, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. Further information can be obtained by communicating with W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 30-DECEMBER 1—National Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Milwaukee, Wis. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

DECEMBER 5-10—THIRTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING in the Grand Central Palace, New York City. Further details can be obtained from Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

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The New Bell 300 mph. "Airacuda" with Cone-geared aileron controls and retractable landing gear.

In the Air CONE GEARS SAVE PRECIOUS POUNDS

For aircraft, Cone Worm Gearing's vastly greater load carrying capacity and efficiency is today contributing increased reliability and durability, with

less gear weight for such parts as aileron controls, retractable landing gears, controllable pitch propellers, gun synchronizers, etc.

AREA CONTACT—machined into Cone Gearing by an exclusive manufacturing process—means just that:

Either smaller gears of equal

load capacity—or greater capacity for the same size gears. Either way, Cone Gearing offers manufacturers of all types

of worm driven equipment the lowest cost per horsepower. Impartial tests and years of service prove: Four times the A.G.M.A.

mechanical, twice the A.G.M.A. thermal rating. The highest efficiencies known.

Up to 30 times the instantaneous tooth contact. Ratios of 150 to one, or 1 to 6.

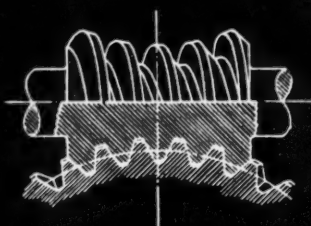
High speed or heavy duty.

No special lubricants. And

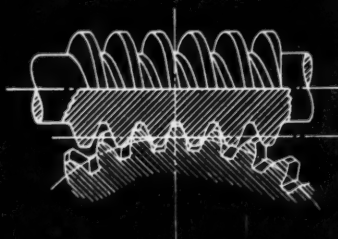
Cone gears—both worms and wheels—wear *in*, not

out. In other words *both*

regenerate as wear occurs. In conventional worm gearing wear destroys the worm form.



Cone gearing provides area contact, i. e., line contact in section.



Conventional worms have line contact, i. e., point contact in section.

For further information on how Cone Gearing is doing a better job on all kinds of equipment, send for Bulletin No. 101-51

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS ROAD
DETROIT, MICHIGAN

NEWS OF THE INDUSTRY

Foreign

LINCOLN ELECTRIC Co., Cleveland, Ohio, manufacturer of arc-welding equipment, has appointed J. M. CHAPPLE managing director of a new manufacturing subsidiary, the Lincoln Electric Co. (Australia) Pty., Ltd., recently established at Alexandria, Sydney, Australia. Mr. Chapple has had long experience in the welding industry, especially abroad.

California

ACME ELECTRIC WELDER Co., Huntington Park, Calif., has appointed as distributors, the WELDING ENGINEERING SALES CORPORATION, 110 E. 42nd St., New York City, in the New York area; ROBERT W. HOFFMAN Co., 13 S. Clinton St., Chicago, Ill., in the Chicago area; JOSEPH N. MOYER, 465 N. Fifth St., Philadelphia, Pa., in the Philadelphia area; VICTOR EQUIPMENT Co., 844 Folsom St., San Francisco, Calif., in northern California; and MEYER MACHINERY Co., 1939 Santa Fé Ave., Los Angeles, Calif., in southern California.

DRIVER-HARRIS Co., Harrison, N. J., announces that the company is represented on the Pacific Coast by the ELECTRICAL SPECIALTY Co., LTD., with a warehouse at 316 Eleventh St., San Francisco, Calif., where high-nickel content alloys, particularly Nichrome and Nichrome V, are available for immediate delivery. Nichrome stocks will also be maintained in Los Angeles and Seattle.

SYNTHANE CORPORATION, Oaks, Pa., manufacturer of Synthane Bakelite-laminated, has appointed GEORGE H. ROSS representative in San Francisco, Calif., with offices at 7 Front St.

Illinois and Indiana

VASCOLOY-RAMET CORPORATION, North Chicago, Ill., manufacturer of tantalum-carbide tools and dies, announces that dealer arrangements have been made by the corporation with the following companies: ARMSTRONG BROS. TOOL Co., Chicago, Ill.; APEX TOOL & CUTTER Co., Shelton, Conn.; PRATT & WHITNEY Co., Hartford, Conn.; DAVIS BORING TOOL DIVISION OF LARKIN PACKER Co., St. Louis, Mo.; WENDT-SONIS DRILL WORKS, Hannibal, Mo.; GENESEE TOOL Co., INC., Fenton, Mich.; TUNGSTEN CARBIDE TOOL Co. (Division of Michigan Tool Co.), Midwest TOOL & MFG. Co., MORSE TOOL Co., and COLE CARBIDE INDUSTRIES, all of Detroit, Mich.

DEAN H. T. HEALD has been elected president of the Armour Institute of Technology, Chicago, Ill. Dean Heald, although only thirty-four years old, is known as an outstanding educator and as a man of remarkable administrative ability.

AMERICAN ART ALLOYS, INC., Kokomo, Ind., formerly the American Dirigold Corporation of the same city, announces a change in its corporate name as indicated.

Michigan and Wisconsin

OMER E. ROBBINS Co., 635 Mt. Elliott Ave., Detroit, Mich., has been organized by Omer E. Robbins, president of the Robbins Engineering Co., Detroit, Mich., to manufacture and handle the sale of Magna-Sine, a magnetic chuck which is adjustable to any required grinding angle, and which has been a product of the Robbins Engineering Co. for the last two and a half years. The new company will have separate manufacturing facilities in a new plant at Ann Arbor, Mich., and will maintain offices at the Detroit address given.

SPECIAL ENGINEERING SERVICE, 267 Vine-wood Ave., Detroit, Mich., has recently been organized to render engineering service in the designing of special machines, dies, tools, fixtures, and other labor-saving devices. The concern is also qualified to design hydraulic die-casting machines, molding equipment, bending machines, and progressive high-production dies.

A. C. HOWARD has been appointed general manager of the Fairbanks, Morse & Co.'s plant at Beloit, Wis. Mr. Howard has been with the company for twenty-two years and has been assistant general manager of the Beloit plant for the last six years.

New England

VAN NORMAN MACHINE TOOL Co., Springfield, Mass., announces that the company has purchased the Producto Machine Co. of Bridgeport, Conn. A new building has been started in Springfield to house this new division. The manufacture of Producto machines will be started in Springfield within a month.

GEORGE D. HARTLEY, for many years treasurer and general manager of Sleeper & Hartley, Worcester, Mass., has established an office for general consultation at 311 Main St., Worcester,



George D. Hartley

Mass., to handle problems relating to inventions, patents, experimental and development work, plant and shop surveys, designing and building of machine equipment, production methods, management and sales, as well as the marketing of new processes and inventions.

R AND L TOOLS, 1825 Bristol St., Philadelphia, Pa., manufacturers of R and L turning tools, tap- and die-holders, and universal toolposts, have appointed GEORGE G. PRAGST, 260 Esten Ave., Pawtucket, R. I., exclusive representative in the New England territory.

AMERICAN SCREW Co., Providence, R. I., has appointed W. P. GETTY, JR., to cover the metropolitan New York area and the state of New Jersey; J. J. COY, to cover the middle west from Detroit; and JOHN S. DODGE to cover the New England territory.

PACKER MACHINE Co., Meriden, Conn., builder of automatic polishing and buffing machines, has recently purchased a new factory located at 452-456 Center St., Meriden, Conn. The new factory building will practically quadruple the amount of floor space available as compared with the old plant.

New York and New Jersey

RUFUS E. ZIMMERMAN, vice-president of research and technology of the United States Steel Corporation, received the degree of Doctor of Science from Franklin and Marshall College, Lancaster, Pa., at the commencement exercises held June 1. Mr. Zimmerman graduated from this college in 1908, and later attended Massachusetts Institute of Technology, from which he graduated in 1911. He joined the American Sheet & Tin Plate Co. of Pittsburgh as research associate in 1914, and in 1933 became vice-pres-

ident in charge of metallurgy and research of the United States Steel Corporation.

CARL ZEISS, INC., 485 Fifth Ave., New York City, announces that the annual course that has come to be known as the "Jena Fall Course" will be held this year during the last week of September at the Zeiss Works in Jena, Germany. The course will cover spectrographic analysis; the design, manufacture, and use of precision measuring instruments; microscopy; metallography; precision methods of gaging, etc. No charge is made for the course. Further details may be obtained by addressing Carl Zeiss, Inc., 485 Fifth Ave., New York.

HAROLD L. CURTIS has been appointed sales promotion and advertising manager of the Shell Union Oil Corporation, 50 W. 50th St., New York City. Mr. Curtis was formerly manager of the metropolitan New York division of the Shell company. He has been with the organization for fifteen years.

GREENE, TWEED & Co., 109 Duane St., New York City, at a recent directors' meeting, elected F. J. DEMAREST president, and H. G. RUSSELL treasurer and general manager. J. A. McKEON remains vice-president, and H. A. ERWOOD, secretary.

LEE F. ADAMS has been made manager of the newly formed standards department of the General Electric Co., Schenectady, N. Y. Mr. Adams has been with the General Electric Co. since 1909.

AJAX ELECTROTHERMIC CORPORATION, Trenton, N. J., announces that among the recent exhibitions open to the public at the Franklin Institute in Philadelphia is one donated by the company, showing the heating effect of induced high-frequency currents, with all parts of the equipment arranged in a glass case. By pushing a button one can see just what happens during the heating cycle.

MAGNUS CHEMICAL Co., INC., Garwood, N. J., manufacturer of cleaning materials, sulfonated oils, and metal-working lubricants, has appointed CARL GEYER sales representative in Ohio and West Virginia; RALPH NEELY, in California; and CARL STEINBERG, in sections of Pennsylvania.

NATIONAL TOOL Co., Cleveland, Ohio, has appointed the ERNEST T. GROPLER Co., 1060 Broad St., Newark, N. J., as its representative in New York State and northern New Jersey, for its line of hobs, broaches, and other cutting tools.

Ohio

ROBERT H. HEYER, metallurgist in the research laboratories of the American Rolling Mill Co., Middletown, Ohio, was awarded the Charles B. Dudley medal of the American Society for Testing

Materials at the annual meeting of the Society in Atlantic City during the last week of June. The medal was awarded Mr. Heyer for his paper "Analysis of the Brinell Hardness Test," presented at the Society's 1937 annual meeting.

A. J. JENNINGS has been appointed general sales manager of the Cleveland Worm & Gear Co., Cleveland, Ohio, and its affiliate, the Farval Corporation. Mr. Jennings directed Farval sales for many years, coming to Cleveland in 1932 when the Farval business was purchased by the Cleveland Worm & Gear Co.

WESLEY P. SYKES, metallurgical engineer at the Cleveland Wire Works of the General Electric Co., was recently awarded an honorary degree of Doctor of Engineering by the Case School of Applied Science, Cleveland, Ohio.

R. J. SCHULER has been appointed general sales representative of the Union Drawn Steel Division of the Republic Steel Corporation, Cleveland, Ohio.

LOUIS POOCK, vice-president and general manager of the Sheffield Gage Corporation and the Cimatool Co. of Dayton, Ohio, has been elected chairman of the Dayton-Cincinnati-Columbus Section of the Society of Automotive Engineers for the year 1938-1939.

DAVID T. MARVEL has been appointed manager of tube sales by the Timken Roller Bearing Co., Canton, Ohio. Mr. Marvel will have charge of the sale of all types of Timken seamless steel tubing. His headquarters will be at the main office in Canton.

W. W. TANGEMAN, vice-president of Cincinnati Milling Machine and Cincinnati Grinders Inc., Cincinnati, Ohio, has been elected vice-chairman of the Cincinnati division of the Society of Automotive Engineers.

WESTCOTT CHUCK Co., Oneida, N. Y., announces that FRED D. BAKER, Lakewood, Ohio, will act as factory representative in northern and central Ohio, working in conjunction with Westcott distributors in that territory.

Pennsylvania and Maryland

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City, has established a new field office located in the Grant Bldg., Pittsburgh, Pa., under the direction of H. V. BEASLEY, who for the last three years has been attached to the New York office. The main function of the new office will be to promote the application of nickel-alloy steels and stimulate interest in nickel cast irons and in nickel non-ferrous alloys.

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa., announces that the Westinghouse company expects to spend, in 1938, approximately \$12,000,000 for

new buildings, new machinery and equipment, as well as other improvements and repairs, in the various plants of the company. That sum is approximately the same as that appropriated for similar projects in 1937.

RAYMOND M. DENNIS, who has been superintendent of the flanging department of the Lukens Steel Co., Coatesville, Pa., since 1928, has been appointed



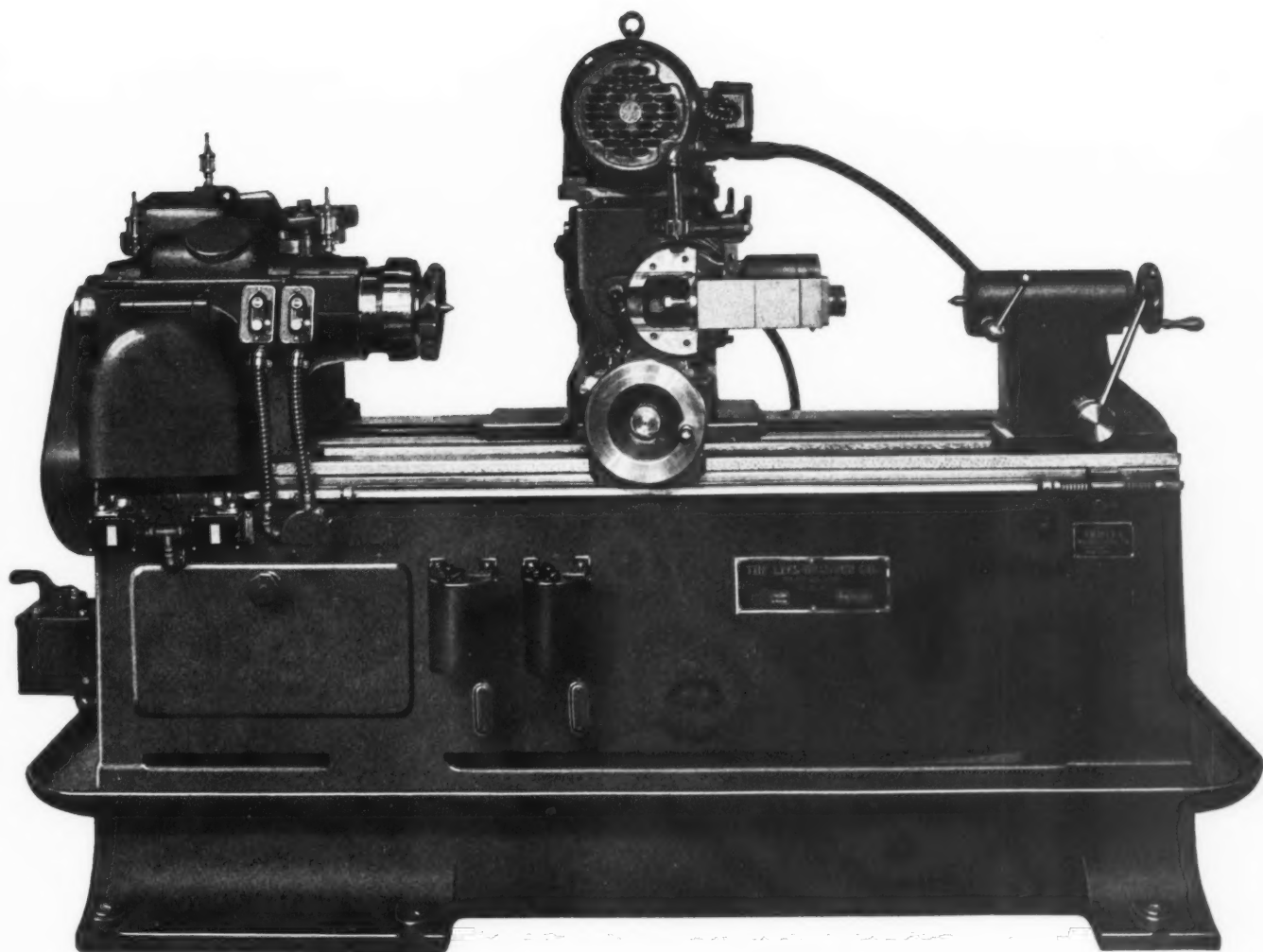
Raymond M. Dennis, General Manager of the Flanging Department of Lukens Steel Co.

general manager of the flanging department in charge of estimating, sales, and production. Mr. Dennis graduated from the University of Pennsylvania in 1910 and has been with the Lukens organization since 1925.

PERCY T. OLDHAM has been appointed manager of special sales for the By-Products Steel Corporation, division of the Lukens Steel Co., Coatesville, Pa. Mr. Oldham has been with the Lukens Steel Co. since 1915.

AJAX STEEL & FORGE Co., 205 Adair St., Detroit, Mich., designers and engineers of special machinery, tools, jigs, fixtures, and dies, has appointed the MACHINE & TOOL DESIGNING Co., 1011 Chestnut St., Philadelphia, Pa., representative in eastern Pennsylvania, eastern New York, New Jersey, Delaware, Maryland, and Washington, D. C.

FEDERAL ENGINEERING Co., INC., 1528 Walnut St., Philadelphia, Pa., has been formed to act in a consulting capacity in construction and mechanical engineering. The company will also act as manufacturers' representative. AXEL MALM is president; C. HENRY HEPPENSTALL, vice-president and treasurer; and EDWARD PARRISH, secretary.

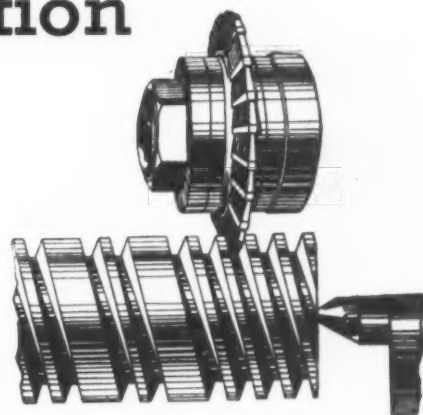


BETTER PROFITS Through Better Production

Advanced Lees-Bradner design means better profits through better production. The new **Lees-Bradner "L-T" Thread Miller** will cut all leads from 32 threads per inch, to one turn in 60 inches on work up to 6" diameter, 36" or 72" between centers. Separate work spindle and cutter head motors mean faster, more versatile operation. Motors are electrically interconnected to prevent spoilage of work. Slide ways and lead screw are fully protected from injury.

These are the high-light features that **Lees-Bradner** has built into the "LT" and "HT" Thread Millers. Used by the Aviation Industry for threading propeller hubs, blades and many other component parts.

How do you produce your threads? Do you require **Accuracy, Finish and Production?** If so, get the complete story in our special folders.



Milling thread on a worm or lead screw with single cutter on the Standard Lees-Bradner Thread Miller. Ring type and internal thread milling can also be done on this machine.

THE LEES-BRADNER COMPANY
CLEVELAND, OHIO, U. S. A.

A. J. KOETSIER has been appointed superintendent of the Micarta Division of the Westinghouse Electric & Mfg. Co. at Trafford, Pa. Mr. Koetsier is a graduate of the University of Michigan, class of 1922.

MARSHALL POST, vice-president of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., was elected president of the American Foundrymen's Association at its annual meeting in Cleveland, May 18.

WALTER K. DOW has been elected vice-president of the Alexander Milburn Co., Baltimore, Md., manufacturer of welding and cutting apparatus, paint spray equipment, etc. Before becoming associated with the Milburn company, Mr. Dow was for ten years with the DeVilbiss Co., Toledo, Ohio.

Schaick was born in 1882. His early business experience was with the Pittsburgh Plate Glass Co. and the Lackawanna Steel Co. In 1919 he joined the American Chain Co. at Bridgeport, Conn., as manager of sales. Several years later he was elected a director, and three years ago he was made vice-president in charge of sales.

RICHARD C. LEWIS, sales engineer of Farrel-Birmingham Co., Inc., Ansonia, Conn., was killed in an airplane accident May 24. At the time of his death, Mr. Lewis was manager of the rolling mill

sales division of the Farrel-Birmingham Co. Previously, he had been with the engineering department as division engineer in charge of rolling mills, metal-working machinery, roll grinders, etc. Mr. Lewis was born in Ansonia, Conn., in 1896. He was graduated from the Worcester Polytechnic Institute in 1919, after which he immediately entered the employ of the Farrel Foundry & Machine Co. He was a member of the American Society of Mechanical Engineers and the American Society for Metals. He is survived by his wife, one son, father, and a sister.

OBITUARIES

Benjamin F. Curtis

Benjamin F. Curtis, traffic manager of the Norton Co., Worcester, Mass., for the last fifty years, died suddenly



Benjamin F. Curtis

June 10 at the age of sixty-nine years. Mr. Curtis came with the Norton Co. in 1887, two years after its founding, and retired in 1937.

ARTHUR P. VAN SCHAIK, vice-president in charge of sales of the American Chain & Cable Co., Inc., Bridgeport, Conn., died June 7 while traveling from New Orleans to Chicago. Mr. Van

SAE HANDBOOK (1938). 776 pages, 5 1/2 by 8 1/2 inches. Published by the Society of Automotive Engineers, Inc., 29 W. 39th St., New York City. Price, members, \$2.50; non-members, \$5.

This is the 1938 edition of the Handbook of the Society of Automotive Engineers, containing the current standards and recommended practices adopted by the Society. New and revised standards and recommended practices issued during a current year are incorporated in the next annual edition. Three classes of standards or informational data are issued by the Society, namely, SAE standards, which are specifications based on sound, established engineering practice; SAE recommended practices, which are specifications based on sound engineering principles and intended as guides toward standard engineering practice; and general information, consisting of data related to the SAE standards or recommended practices considered of sufficient value to include in the Handbook.

The book contains ten sections covering the following subjects: Units, parts, and fittings; processed materials; fabricated materials; screws, bolts, and washers; tests, ratings, and codes; transportation and maintenance; tools and production equipment; nomenclature and definitions; miscellaneous specifications; and standards committee regulations.

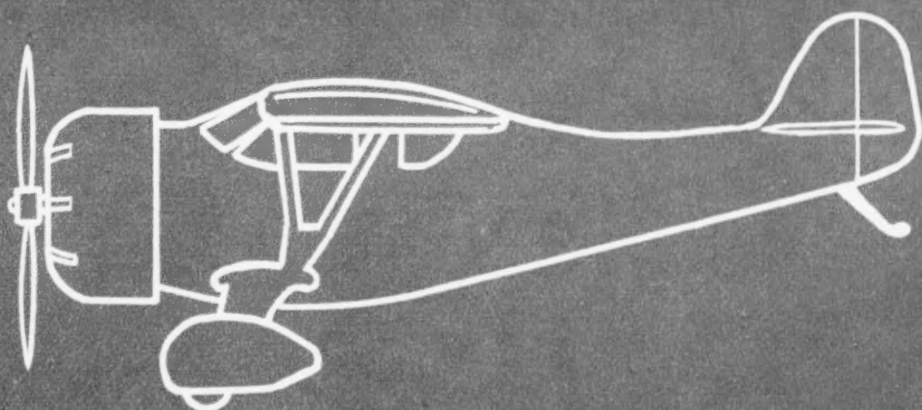
KENT'S MECHANICAL ENGINEERS' HANDBOOK. Section on Design and Shop Practice. Eleventh edition, rewritten by Robert Thurston Kent in collaboration with a staff of specialists. 1378 pages, 5 1/2 by 8 1/2 inches. Published by John Wiley & Sons, Inc., New York City. Price, \$5.00.

The division of Kent's well-known handbook into two volumes has permitted a more thorough treatment of the material in the earlier editions and the inclusion of many new subjects. The

development in the last ten years of many new materials of engineering and the improvement in tools, machinery, and processes have made much of the information in the earlier editions obsolete. This handbook, therefore, has practically been rewritten. In the selection of the material the author states that the same principle has been applied as that which governed the ten preceding editions, namely, that the book should cover the practice of mechanical engineering and present data that would be useful to engineers in their everyday work. A listing of the sections contained will indicate the scope of the work: General properties of materials; iron and steel; corrosion and corrosion-resistant metals; non-ferrous metals and alloys; non-metallic materials; fabricated materials; strength of materials; mechanism and mechanics; fastenings; mechanical springs; rotating members; keys, cotters, pins, tapers, and fits; bearings and lubricants; gearing; control mechanisms; vibration and noise; structures and buildings; industrial heating processes; forging practice; foundry practice; the machine shop; woodworking; materials handling; mechanical power transmission; electric motors and their control; miscellaneous shop equipment; safety engineering; mathematical tables.

BARLOW'S TABLES OF SQUARES, CUBES, SQUARE ROOTS, CUBE ROOTS AND RECIPROALS. Edited by L. J. Comrie. 208 pages, 5 1/2 by 8 1/2 inches. Published in Great Britain. Exclusive distributors in North and South America, the Chemical Publishing Co. of N. Y., Inc., 148 Lafayette St., New York City. Price, \$3.

This is the third edition of the well-known Barlow's Tables which give squares, cubes, square roots, cube roots, and reciprocals directly of every number up to 10,000. The tables have been reset in modern type with interlinear differences for interpolation, and with the addition of a column showing the square

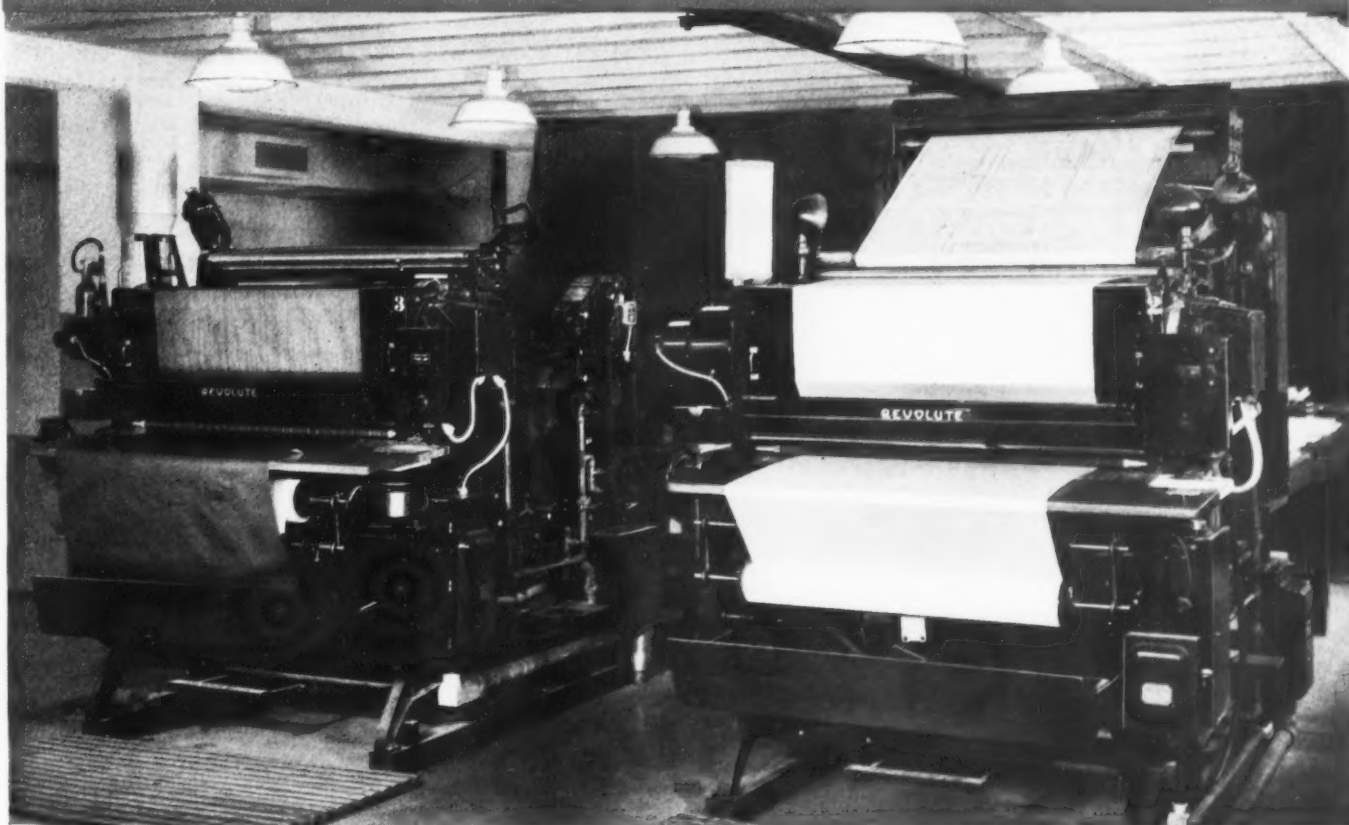


IN AIRCRAFT MANUFACTURE IT'S THE **REVOLUTE** FOR TOP QUALITY PRINTS AT LOW COST!

REVOLUTE Automatic Blue Printing Machines find ready acceptance in the aviation field—they are applied with advantage in a large number of aircraft plants. The photograph below was taken at the Glenn L. Martin Plant at Baltimore, and shows two REVOLUTE Machines. One has been serving the plant economically for a number of years—and when an

additional machine was needed, the choice again was for REVOLUTE. Exclusive features assure excellent prints, easy control, rapid operation, and lowest possible costs—all in a carefully engineered, quality built machine. Full particulars are available in a new bulletin, just off the press. Your copy mailed without obligation.

PARAGON - REVOLUTE CORPORATION, ROCHESTER, N. Y.



REVOLUTES—at The Glenn L. Martin Plant.

roots of all numbers from 10,000 to 100,000 at intervals of ten. Other new tables give the fourth, fifth, sixth, seventh, eighth, ninth and tenth powers of all numbers from 1 to 100, and up to the twentieth power of numbers from 1 to 10. Tables of important constants given to fifteen decimals are also included. An introduction dealing with interpolation and special uses of the tables will also be found of value.

Barlow's Tables were first published in 1814. In 1840, a new plated edition was brought out. The present edition has come into existence partly because the plates that have been used for ninety years show evidence of wear, but mainly because the ever-increasing demand for these tables has made it possible for the publishers to meet the expense of resetting the work in modern type. Great precautions have been taken to secure complete freedom from errors. Comparisons have been made with various other tables available in France and Germany, and the values have been checked by the use of calculating machines.

ELECTRIC WELDING. By Morgan H. Potter. 126 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, \$1.25.

This book covers the fundamental principles and applications of the various types of electric arc welding. The author, who is instructor of general shops in the William Hood Dunwoody Industrial Institute, has written the book in a simple manner, easily understood by the apprentice or man just entering the welding industry. The text covers forge or blacksmith welding; oxy-acetylene or gas welding; thermit welding; electric resistance welding; electric arc welding; welding machines; protective equipment; auxiliary equipment; quality of weld metal; electric arc; effect of atmosphere on fused metal; preparation for welding; flat welding; vertical welding; overhead welding; welding heavier plates; arrangement of leads for various jobs; strength of weld; weldability of various metals; miscellaneous welding jobs; and welding machines using power tube rectifiers.

THE PRINCIPLES AND PRACTICE OF LUBRICATION. By Alfred W. Nash and A. R. Bowen. 356 pages, 5 1/2 by 8 1/2 inches, 96 illustrations. Published in Great Britain. Exclusive distributors in North and South America, the Chemical Publishing Co. of N. Y., Inc., 148 Lafayette St., New York City. Price, \$8.50.

This book has been prepared specifically for the lubricating oil user, the designing and operating engineer, and, in fact, anyone who needs a sound and thorough knowledge of lubrication. The chapters in this book summarize concisely the salient features of the subject of friction and lubrication. The scientific principles are given, as far as possible, in non-technical language, and those

whose knowledge of chemistry and physics may be elementary, should have no difficulty in following the authors' reasoning. The book covers the following subjects: Friction; specific gravity and viscosity; design and lubrication of bearings; source of lubricants; the chemistry of lubricants; chemical and physical tests for lubricating oils; industrial lubrication practice; mechanical friction-testing machines; and the care of lubricants.

MECHANICS OF MACHINERY. By C. W. Ham and E. J. Crane. 476 pages. 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, \$4.

This is the second edition of a work on the mechanics of machinery. The same general sequence has been followed as in the first edition—that is, the material is divided into two parts, the first dealing with mechanism and the second with kinematics and dynamics of machinery. The first section covers link-work, cams, gearing, belts and chains, intermittent-motion mechanisms, and trains of mechanisms. The second section discusses velocities, accelerations, static and inertia forces, balancing, etc. A large number of problems have been added in this edition.

MACHINE, CARRIAGE, AND LAG BOLTS (STEEL). 21 pages, 6 by 9 inches. Published by the U. S. Department of Commerce, Washington, D. C., as Simplified Practice Recommendation R169-37 of the National Bureau of Standards. Price, 5 cents.

THE CASE FOR FREEDOM FROM FEDERAL CONTROL OF WAGES AND HOURS. 24 pages, 6 by 9 inches. Published by the Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill.

COMING EVENTS

JULY 25-29—INTERNATIONAL CONGRESS ON TECHNICAL EDUCATION in Berlin, Germany. Further information may be obtained by addressing the Bureau International de L'Enseignement Technique, 2 Place de la Bourse, Paris (2e), France.

SEPTEMBER 19-23—SEVENTH INTERNATIONAL MANAGEMENT CONGRESS at Washington, D. C. Executive secretary, Nathaniel W. Barnes, Room 1201, 347 Madison Ave., New York City.

SEPTEMBER 21-23—Sixteenth annual conference of the NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION at the Hotel Statler, Cleveland, Ohio. Stanley Kniseley, general conference chairman, Republic

Steel Corporation, Cleveland, Ohio; Ralph Leavenworth, program committee chairman, Fuller & Smith & Ross, Inc., Cleveland, Ohio. For further information, communicate with J. A. Martz, 400 W. Madison St., Chicago, Ill.

OCTOBER 10-14—NATIONAL SAFETY CONGRESS, to be held at the Stevens Hotel, Chicago, Ill., under the auspices of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill.

OCTOBER 13-15—National Aircraft Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Ambassador Hotel, Los Angeles, Calif. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

OCTOBER 14-16—FOREMEN'S EXPOSITION to be held in Goodyear Hall, Akron, Ohio, under the auspices of the National Association of Foremen, and in conjunction with the fifteenth annual convention of the Association. For further information address Clapp & Poliak, Inc., 232 Madison Ave., New York City.

OCTOBER 17-21—NATIONAL METAL CONGRESS AND EXHIBITION, to be held in Convention Hall, Detroit, Mich., under the auspices of the American Society for Metals. Further information can be obtained by communicating with W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

OCTOBER 27-29—First regional conference of the Chicago Chapter of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Purdue University, Lafayette, Ind. For further information address Professor William Knapp, Assistant Dean of Engineering, Purdue University, Lafayette, Ind.

NOVEMBER 11-19—NATIONAL AUTOMOBILE SHOW at Grand Central Palace, New York City, under the auspices of the Automobile Manufacturers Association, 366 Madison Ave., New York City.

NOVEMBER 14-16—National Transportation Engineering Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Commodore Hotel, New York City. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

NOVEMBER 30—DECEMBER 1—National Production Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Milwaukee, Wis. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

DECEMBER 5-10—THIRTEENTH NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING in the Grand Central Palace, New York City. Further details can be obtained from Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

JANUARY 9-13, 1939—Annual Meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

MACHINERY'S DATA SHEETS 353 and 354

TABLE FOR CHANGING DEGREES FAHRENHEIT TO DEGREES CENTIGRADE—3

Degrees Fahrenheit	0	10	20	30	40	50	60	70	80	90
	Degrees Centigrade*									
3700	2037.7	2043.3	2048.8	2054.4	2060.0	2065.5	2071.1	2076.6	2082.2	2087.7
3800	2093.3	2098.8	2104.4	2110.0	2115.5	2121.1	2126.6	2132.2	2137.7	2143.3
3900	2148.8	2154.4	2160.0	2165.5	2171.1	2176.6	2182.2	2187.7	2193.3	2198.8
4000	2204.4	2210.0	2215.5	2221.1	2226.6	2232.2	2237.7	2243.3	2248.8	2254.4
4100	2260.0	2265.5	2271.1	2276.6	2282.2	2287.7	2293.3	2298.8	2304.4	2310.0
4200	2315.5	2321.1	2326.6	2332.2	2337.7	2343.3	2348.8	2354.4	2360.0	2365.5
4300	2371.1	2376.6	2382.2	2387.7	2393.3	2398.8	2404.4	2410.0	2415.5	2421.1
4400	2426.6	2432.2	2437.7	2443.3	2448.8	2454.4	2460.0	2465.5	2471.1	2476.6
4500	2482.2	2487.7	2493.3	2498.8	2504.4	2510.0	2515.5	2521.1	2526.6	2532.2
4600	2537.7	2543.3	2548.8	2554.4	2560.0	2565.5	2571.1	2576.6	2582.2	2587.7
4700	2593.3	2598.8	2604.4	2610.0	2615.5	2621.1	2626.6	2632.2	2637.7	2643.3
4800	2648.8	2654.4	2660.0	2665.5	2671.1	2676.6	2682.2	2687.7	2693.3	2698.8
4900	2704.4	2710.0	2715.5	2721.1	2726.6	2732.2	2737.7	2743.3	2748.8	2754.4
5000	2760.0	2765.5	2771.1	2776.6	2782.2	2787.7	2793.3	2798.8	2804.4	2810.0
5100	2815.5	2821.1	2826.6	2832.2	2837.7	2843.3	2848.8	2854.4	2860.0	2865.5
5200	2871.1	2876.6	2882.2	2887.7	2893.3	2898.8	2904.4	2910.0	2915.5	2921.1
5300	2926.6	2932.2	2937.7	2943.3	2948.8	2954.4	2960.0	2965.5	2971.1	2976.6
5400	2982.2	2987.7	2993.3	2998.8	3004.4	3010.0	3015.5	3021.1	3026.6	3032.2
5500	3037.7	3043.3	3048.8	3054.4	3060.0	3065.5	3071.1	3076.6	3082.2	3087.7
5600	3093.3	3098.8	3104.4	3110.0	3115.5	3121.1	3126.6	3132.2	3137.7	3143.3
5700	3148.8	3154.4	3160.0	3165.5	3171.1	3176.6	3182.2	3187.7	3193.3	3198.8
5800	3204.4	3210.0	3215.5	3221.1	3226.6	3232.2	3237.7	3243.3	3248.8	3254.4
5900	3260.0	3265.5	3271.1	3276.6	3282.2	3287.7	3293.3	3298.8	3304.4	3310.0

*See note on Data Sheet No. 351, August, 1937.

MACHINERY'S Data Sheet No. 353, New Series, September, 1937

Based on Tables Published by the National Bureau of Standards

TABLE FOR CHANGING DEGREES FAHRENHEIT TO DEGREES CENTIGRADE—4

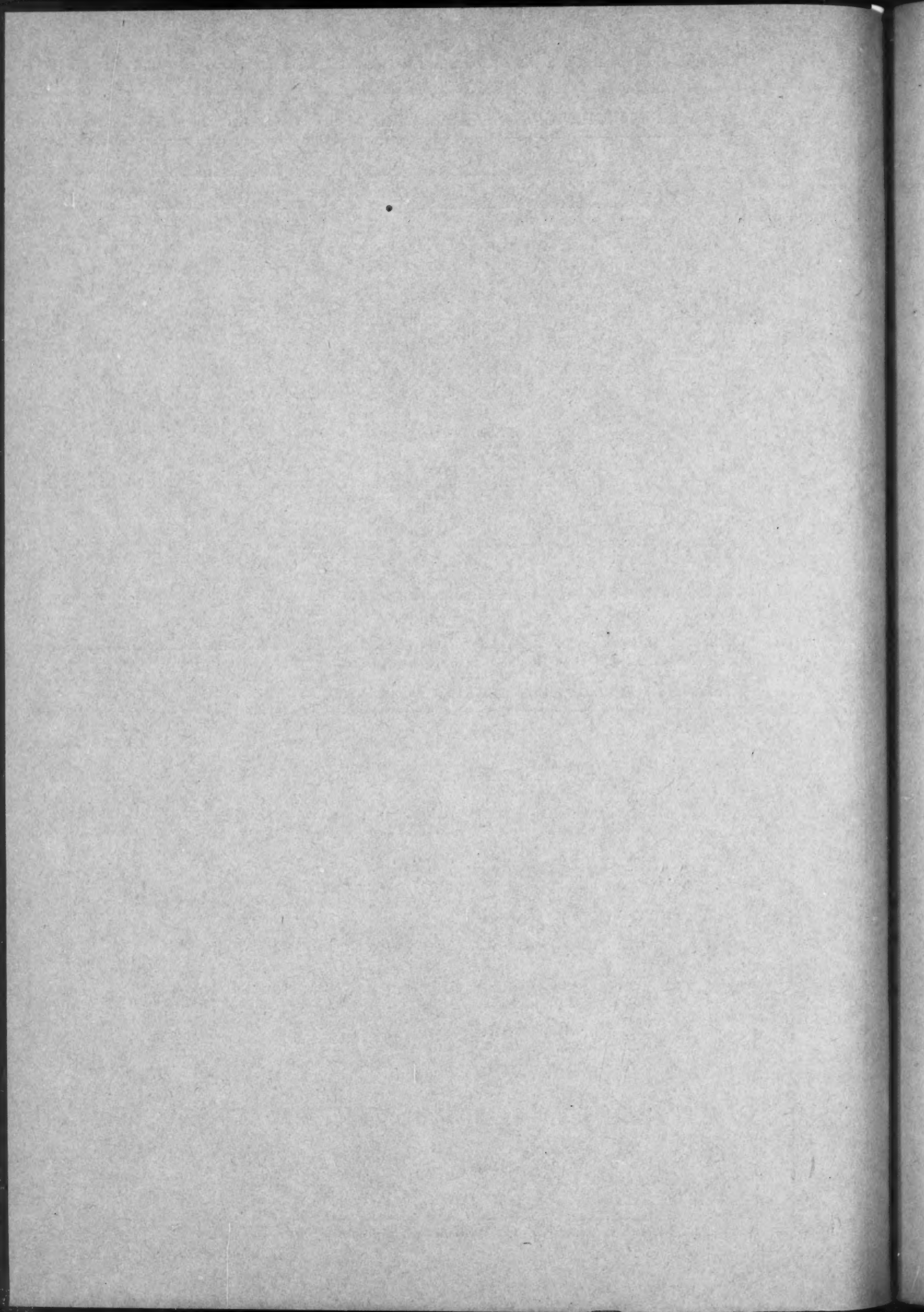
Degrees Fahrenheit	0	10	20	30	40	50	60	70	80	90
	Degrees Centigrade*									
6000	3315.5	3321.1	3326.6	3332.2	3337.7	3343.3	3348.8	3354.4	3360.0	3365.5
6100	3371.1	3376.6	3382.2	3387.7	3393.3	3398.8	3404.4	3410.0	3415.5	3421.1
6200	3426.6	3432.2	3437.7	3443.3	3448.8	3454.4	3460.0	3465.5	3471.1	3476.6
6300	3482.2	3487.7	3493.3	3498.8	3504.4	3510.0	3515.5	3521.1	3526.6	3532.2
6400	3537.7	3543.3	3548.8	3554.4	3560.0	3565.5	3571.1	3576.6	3582.2	3587.7
6500	3593.3	3598.8	3604.4	3610.0	3615.5	3621.1	3626.6	3632.2	3637.7	3643.3
6600	3648.8	3654.4	3660.0	3665.5	3671.1	3676.6	3682.2	3687.7	3693.3	3698.8
6700	3704.4	3710.0	3715.5	3721.1	3726.6	3732.2	3737.7	3743.3	3748.8	3754.4
6800	3760.0	3765.5	3771.1	3776.6	3782.2	3787.7	3793.3	3798.8	3804.4	3810.0
6900	3815.5	3821.1	3826.6	3832.2	3837.7	3843.3	3848.8	3854.4	3860.0	3865.5
7000	3871.1	3876.6	3882.2	3887.7	3893.3	3898.8	3904.4	3910.0	3915.5	3921.1
7100	3926.6	3932.2	3937.7	3943.3	3948.8	3954.4	3960.0	3965.5	3971.1	3976.6
7200	3982.2	3987.7	3993.3	3998.8	4004.4	4010.0	4015.5	4021.1	4026.6	4032.2
7300	4037.7	4043.3	4048.8	4054.4	4060.0	4065.5	4071.1	4076.6	4082.2	4087.7
7400	4093.3	4098.8	4104.4	4110.0	4115.5	4121.1	4126.6	4132.2	4137.7	4143.3
7500	4148.8	4154.4	4160.0	4165.5	4171.1	4176.6	4182.2	4187.7	4193.3	4198.8
7600	4204.4	4210.0	4215.5	4221.1	4226.6	4232.2	4237.7	4243.3	4248.8	4254.4
7700	4260.0	4265.5	4271.1	4276.6	4282.2	4287.7	4293.3	4298.8	4304.4	4310.0
7800	4315.5	4321.1	4326.6	4332.2	4337.7	4343.3	4348.8	4354.4	4360.0	4365.5
7900	4371.1	4376.6	4382.2	4387.7	4393.3	4398.8	4404.4	4410.0	4415.5	4421.1

*See note on Data Sheet No. 351, August, 1937.

MACHINERY'S Data Sheet No. 354, New Series, September, 1937

Based on Tables Published by the National Bureau of Standards

MACHINERY, September, 1937—8-A



MACHINERY'S DATA SHEETS 355 and 356

FEEDS AND SPEEDS FOR MILLING—1

See Data Sheet No. 356 for Instructions on Use of this Table

Depth of Out, Inches	Width of Out, Inches															
	1/4		1/2		3/4		1		1 1/4		1 1/2		2		2 1/2	
	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute
1/4	4.5	110	4.5	110	4.0	105	4.0	105	4.0	100	3.5	100	3.5	100	3.5	95
1/2	4.5	105	4.0	105	4.0	100	4.0	100	3.5	95	3.5	95	3.5	95	3.0	90
3/4	4.0	100	4.0	100	3.5	95	3.5	95	3.5	90	3.0	90	3.0	90	3.0	85
1	4.0	95	3.5	95	3.5	90	3.5	90	3.0	85	3.0	85	3.0	85	2.5	80
1 1/4	3.5	90	3.5	90	3.5	85	3.0	85	3.0	80	3.0	80	2.5	80	2.5	75
1 1/2	3.5	85	3.5	85	3.0	80	3.0	80	3.0	75	2.5	75	2.5	75	2.25	70
2	3.5	80	3.0	80	3.0	75	3.0	75	2.5	70	2.5	70	2.25	70	2.0	65
2 1/2	3.0	80	3.0	75	2.5	75	2.5	70	2.25	70	2.0	65	1.75	65	1.5	65
3	2.5	75	2.5	75	2.25	70	2.0	70	1.75	65	1.5	65	1.25	60	1.0	60
4	2.5	75	2.0	70	1.75	70	1.5	65	1.25	65	1.0	60	...	...	...	...
5	2.0	70	1.5	70	1.25	65	1.0	65	...	...	...	...	...	...	...	...
6	1.75	70	1.5	65	1.00	65	...	...	...	...	...	...	...	...	...	...

Depth of Out, Inches	Width of Out, Inches															
	3		4		5		6		7		8		10		12	
	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute	Feed, Inches per Minute	Speed, Feet per Minute
1/4	3.0	95	3.0	95	3.0	90	2.5	90	2.5	90	2.5	85	2.25	85	2.25	85
1/2	3.0	90	3.0	90	2.5	85	2.5	85	2.25	85	2.25	80	2.0	80	2.0	80
3/4	2.5	85	2.5	85	2.25	80	2.25	80	2.0	80	2.0	75	1.75	75	1.75	75
1	2.5	80	2.25	80	2.25	75	2.0	75	2.0	75	1.75	70	1.5	70	...	...
1 1/4	2.25	75	2.0	75	1.75	70	1.5	70	1.5	70	1.25	65	...	...	...	...
1 1/2	2.0	70	1.75	70	1.5	65	1.25	65	1.0	65	...	...	...	...	...	...
2	1.75	65	1.5	65	1.25	60	1.0	60	...	...	...	...	...	...	...	...
2 1/2	1.25	60	1.0	60	...	...	...	...	...	...	...	...	...	...	...	...

MACHINERY'S Data Sheet No. 355, New Series, October, 1937

Compiled by the National Twist Drill & Tool Co., Detroit, Mich.

FEEDS AND SPEEDS FOR MILLING—2

These Instructions Apply to Use of Data Sheet No. 355

The feeds and speeds given in the table in Data Sheet No. 355 are based on the use of high-speed steel tools on machining SAE 1020 steel. They represent good practice under average shop conditions with present-day equipment. As complete data is not available for all machining conditions, some of the figures given are necessarily empirical. It is believed, however, that the table in its present form will meet a long felt need for a simple data sheet for determining milling feeds and speeds.

The feeds and speeds given for SAE 1020 steel must be multiplied by the proper factor in the following tabulation to obtain the feeds and speeds for other materials:

SAE 1035, Annealed.....	0.8
Tool Steel, Annealed.....	0.6
Alloy Steel, Free Machining.....	0.8
Alloy Steel, Medium Machining..	0.65
Alloy Steel, Tough Machining...	0.5
Cast Steel.....	0.4
Cast Iron, Hard.....	0.7
Cast Iron, Medium.....	0.95
Cast Iron, Soft.....	1.2
Malleable Iron.....	0.8
Brass and Bronze, Free Machining.....	2.5
Brass and Bronze, Medium Machining.....	1.6
Brass and Bronze, Hard Machining.....	0.8
Monel Metal.....	0.7
Magnesium Alloys.....	5.0
Aluminum Alloys.....	2.0

To illustrate the use of the table with an actual example, let us assume that we are to take a milling cut 1/2 inch deep and 1 1/4 inches wide in alloy steel of a medium grade of machinability: Reading to the right from the 1/2-inch horizontal line in the table and downward from the 1 1/4-inch vertical column for the width of cut we find:

Feed = 3.5 inches per minute
Speed = 95 feet per minute

The factor given above for medium-machining alloy steel equals 0.65. Multiplying 3.5 by 0.65 gives us 2.275. Multiplying 95 by 0.65 gives us 61.75. The indicated feed and speed for this case then are:

Feed = 2.275 inches per minute
Speed = 61.75 surface feet per minute

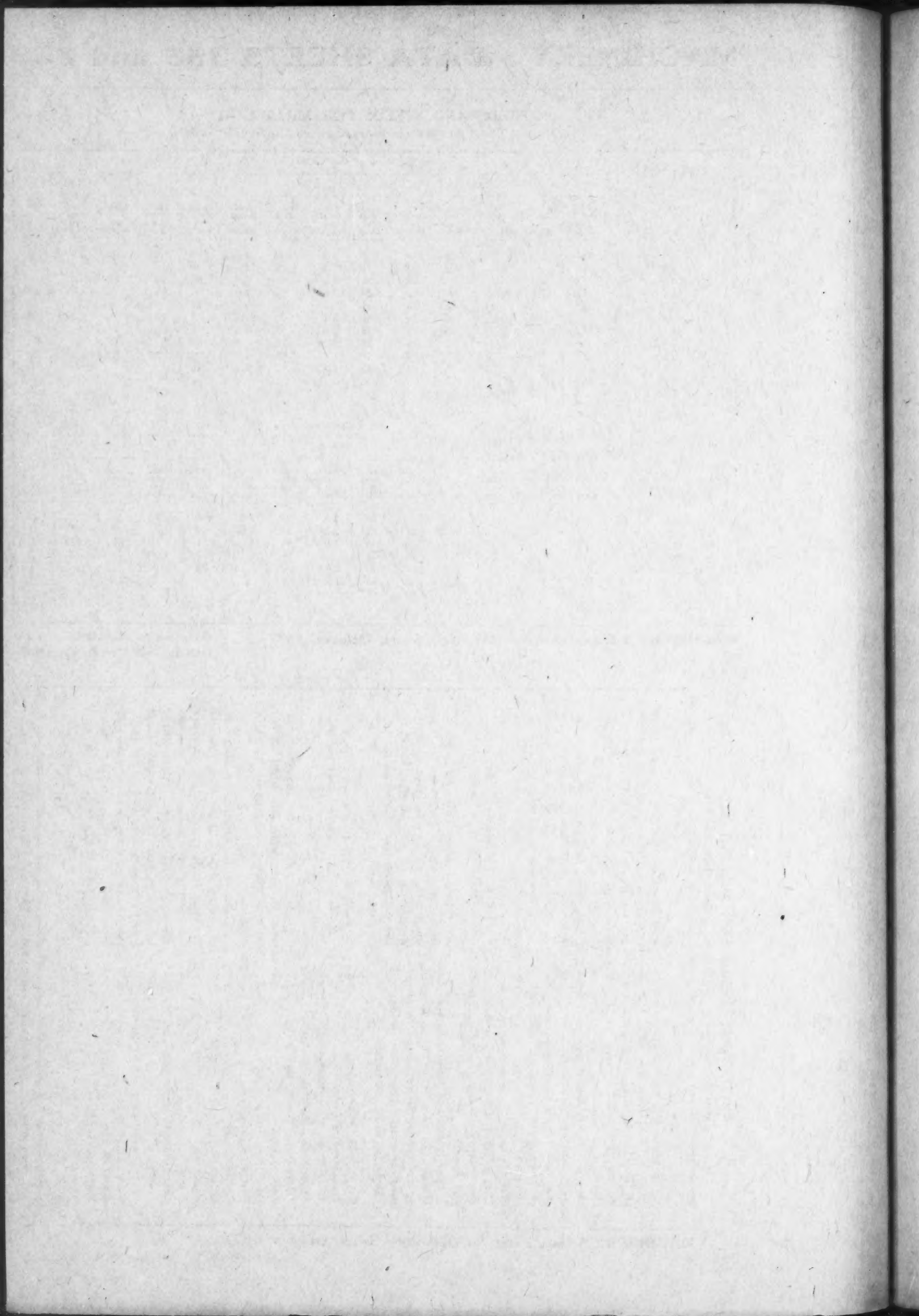
Feeds and speeds for any other material at any depth and width of cut can be quickly computed by this method.

It should be emphasized that the figures obtained will not apply literally to every milling operation, because the rigidity of the machines and setups will vary. Thus, if the milling machine is new and substantial, and the fixtures, arbor, and work rigid, the figures given may be considerably increased. Under adverse conditions, on the other hand, the figures may have to be reduced.

MACHINERY'S Data Sheet No. 356, New Series, October, 1937

MACHINERY, October, 1937—136-A

Compiled by the National Twist Drill & Tool Co., Detroit, Mich.



RADII FOR COLD BENDING OF ALUMINUM

TABLE 1—APPROXIMATE RADII FOR 90° COLD BEND OF ALUMINUM AND ALUMINUM ALLOY SHEET

Minimum permissible radius varies with nature of forming operation, type of forming equipment, and design and condition of tools. Minimum working radius for given material or hardest alloy and temper for a given radius can be ascertained only by actual trial under contemplated conditions of fabrication.

Alloy and Temper	Bend Classification**	Alloy and Temper	Bend Classification**
2S-O	A	A17S-O	B
2S-1/4H	B	A17S-T	F
2S-1/2H	B		
2S-3/4H	D	24S-O ⁽¹⁾	B
2S-H	F	24S-T ⁽¹⁾⁽²⁾	J
		24S-RT ⁽¹⁾	K
3S-O	A	51S-O	A
3S-1/4H	B	51S-W	F
3S-1/2H	C	51S-T	K
3S-3/4H	E		
3S-H	G		
4S-O	B	52S-O	A
4S-1/4H	D	52S-1/4H	C
4S-1/2H	E	52S-1/2H	D
4S-3/4H	G	52S-3/4H	F
4S-H	H	52S-H	G
17S-O ⁽¹⁾	B	53S-O	A
17S-T ⁽¹⁾⁽²⁾	H	53S-W	F
17S-RT ⁽¹⁾	J	53S-T	G

**For corresponding bend radii see following table:

TABLE 2 RADII REQUIRED FOR 90° BEND IN TERMS OF THICKNESS, t						
Approximate Thickness						
B & S Gauge Inch Inch	26 0:016 1/64	20 0:032 1/32	14 0:064 1/16	8 0:128 1/8	5 0:189 3/16	2 0:258 1/4
Bend Classification	A	0	0	0	0	0
B	0	0	0	0	0-1t	0-1t
C	0	0	0	0-1t	0-1t	1/2t-1 1/2t
D	0	0	0-1t	1/2t-1 1/2t	1t-2t	1 1/2t-3t
E	0-1t	1/2t-1 1/2t	1t-2t	1t-2t	1 1/2t-3t	2t-4t
F	1/4t-1 1/2t	1t-2t	1 1/2t-3t	1 1/2t-3t	2t-4t	2t-4t
G	1t-2t	1 1/2t-3t	2t-4t	2t-4t	3t-5t	4t-6t
H	1 1/2t-3t	2t-4t	3t-5t	3t-5t	4t-6t	4t-6t
J	2t-4t	3t-5t	3t-5t	4t-6t	4t-6t	5t-7t
K	2t-4t	3t-5t	3t-5t	4t-6t	5t-7t	6t-10t

⁽¹⁾ Alclad 17S and Alclad 24S can be bent over slightly smaller radii than the corresponding tempers of the uncoated alloy.

⁽²⁾ Immediately after quenching, these alloys can be formed over appreciably smaller radii.

**For corresponding bend radii see following table:

TABLE 2
RADII REQUIRED FOR 90° BEND IN TERMS OF THICKNESS, t

Bend Classification	Approximate Thickness						
	26 Inch. 1/16	20 0.032 1/16	14 0.064 1/16	8 0.128 1/8	5 0.189 3/16	2 0.258 1/4	
A	0	0	0	0	0	0	0-1t
B	0	0	0	0	0	0	1/4t-1 1/2t
C	0	0	0	0	0	0	1/2t-3t
D	0-1t	0-1t	0-1t	0-1t	0-1t	0-1t	1 1/2t-3t
E	0-1t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	2t-4t
F	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	2t-4t
G	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	2t-4t
H	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	2t-4t
J	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	2t-4t
K	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	1/4t-1 1/2t	2t-4t

(1) Alclad 17S and Alclad 24S can be bent over slightly smaller radii than the corresponding tempers of the uncoated alloy.

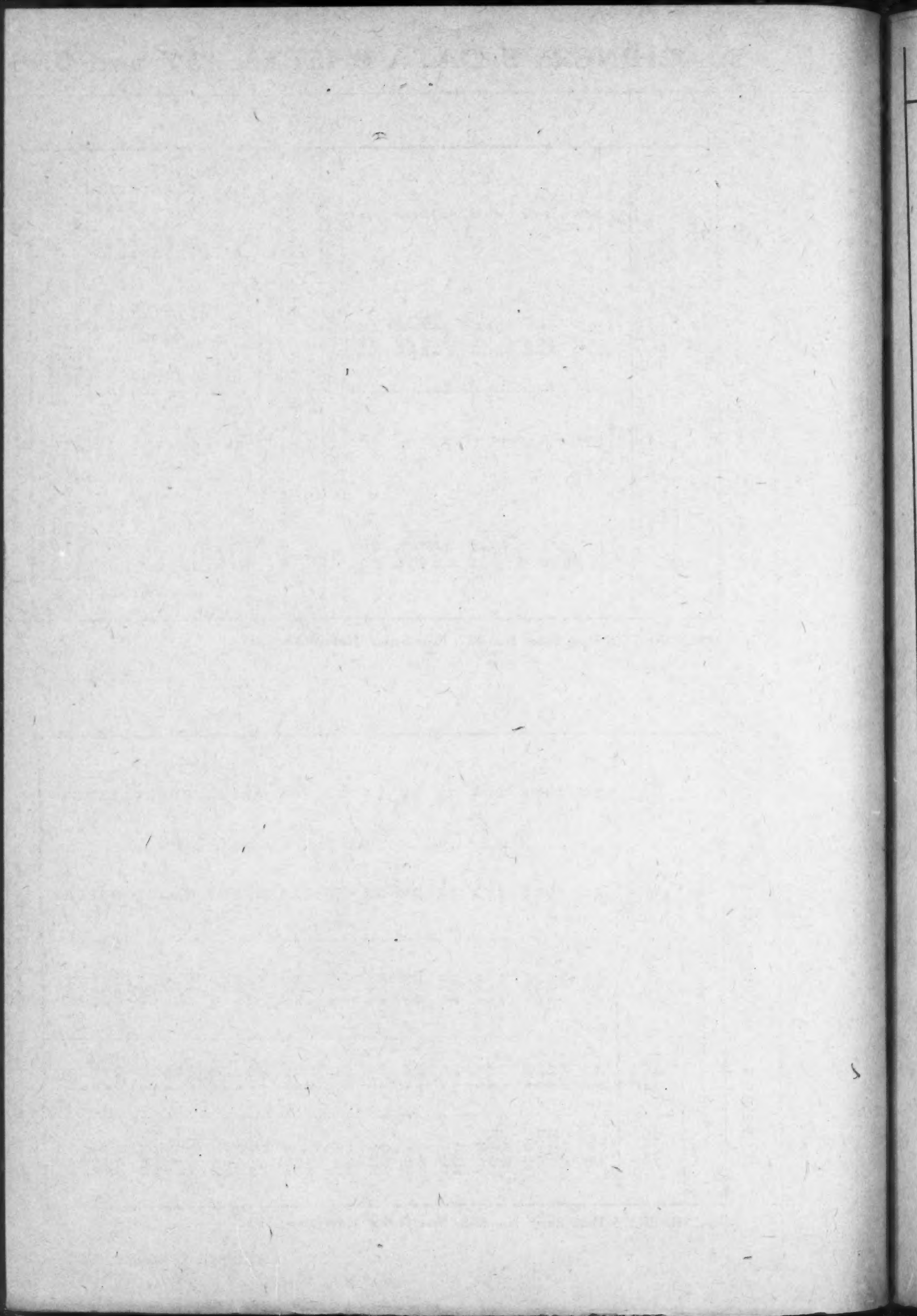
(2) Immediately after quenching, these alloys can be formed over appreciably smaller radii.

Compiled by and Published with the Permission of the Aluminum Company of America

PROPERTIES OF WROUGHT-ALUMINUM ALLOYS

TABLE 3—PROPERTIES OF WROUGHT ALLOYS				
Wrought Alloys	Specific Gravity	Weight Lbs. per Cu. In.	Electrical Conductivity Per Cent of International Copper Standard	Thermal Conductivity Per 100°C. C.G.S. Units
2S-O	2.71	0.098	59	.53
2S-H	2.71	0.098	57	.51
3S-O	2.73	0.099	50	.45
3S-1/4H	2.73	0.099	42	.38
3S-1/2H	2.73	0.099	41	.37
3S-H	2.73	0.099	40	.36
4S-O	2.72	0.098	42	.36
4S-1/4H	2.72	0.098	42	.36
4S-1/2H	2.72	0.098	42	.36
4S-H	2.72	0.098	42	.40
14S-O	2.80	0.101	50	.45
14S-T	2.80	0.101	35	.32
17S-O	2.79	0.101	45	.40
17S-T	2.79	0.101	30	.27
18S-O	2.80	0.101	45	.40
18S-T	2.80	0.101	35	.32
24S-O	2.77	0.100	50	.45
24S-T	2.77	0.100	30	.27
25S-O	2.79	0.101	50	.45
25S-W	2.79	0.101	35	.32
25S-T	2.79	0.101	35	.32
32S-O	2.66	0.096	40	.36
32S-T	2.66	0.096	35	.32
51S-O	2.69	0.097	55	.50
51S-W	2.69	0.097	45	.40
51S-T	2.69	0.097	45	.40
A51S-O	2.69	0.097	50	.45
A51S-W	2.69	0.097	40	.36
A51S-T	2.69	0.097	40	.36
52S-O	2.67	0.096	35	.32
52S-H	2.67	0.096	35	.32
53S-O	2.69	0.097	45	.40
53S-W	2.69	0.097	40	.36
53S-T	2.69	0.097	40	.36
70S-O	2.91	0.105	40	.36
70S-T	2.91	0.105	35	.32

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DROP-FORGING DATA FOR DRAFTSMEN AND DESIGNERS—1

GENERAL INFORMATION ON DROP-FORGINGS

The materials used in making drop-forgings may be carbon or alloy steels, stainless steel, wrought iron, Tobin bronze, Monel metal, aluminum, beryllium copper, and other special alloys.

The weights are of rolled or wrought material unless otherwise specified. The exact weight per cubic inch of different commercial metals varies slightly, but the figures in the table are sufficiently accurate for ordinary weight calculations of forgings.

Information Required in Ordering Drop-Forgings

It is not sufficient to specify "steel," because of the many varieties available, differing both in chemical analysis and physical characteristics. Specify steel by SAE number or by chemical analysis; or give complete engineering data on the application of the forging to be made, stresses to which it will be subjected, etc. Do not hesitate to give such data in great detail.

Specify machineability requirements. State whether forgings are to be delivered normalized or heat-treated. Specify hardness or physical properties, and state requirements, if any, of grain flow or grain size.

Forgings are commonly shipped in a clean sand-blasted finish, free from scale; some users require pickled or tumbled finishes, in which case this should be specified.

Estimated Weight of Drop-Forgings

The accompanying table has been prepared to aid in ascertaining the weight of drop-forgings made from different metals when the total volume in cubic inches has been calculated. The weight relative to a carbon steel forging is also readily ascertained by the "Ratio of

Weights of Metals

Name of Metal	Weight Per Cubic Inch, Pounds	Ratio of Weight to Weight of Carbon Steel, Per Cent
Aluminum	0.098	34.6
Aluminum Bronze	0.271 to 0.296	95.7 to 104.6
Beryllium Copper	0.298	105.3
Brass (80-40) ..	0.306	108.1
Copper	0.324	114.4
Duralumin	0.101	35.7
Everdur	0.305	107.7
Forging Brass ..	0.310	109.5
Iron, Cast	0.260	91.4
Iron, Pure	0.285	100.7
Iron, Stainless ..	0.280	99.0
Lead	0.410	144.8
Monel Metal	0.318	112.8
Steel, Alloy	0.283	100.0
Steel, Carbon ...	0.283	100.0
Steel, High-Speed (18-23 Tungsten)	0.320	113.1
Steel, High-Speed (12-14 Tungsten)	0.311	109.9
Steel, Stainless (13 Chromium)	0.280	99.0
Steel, Stainless (18-8)	0.285	100.7

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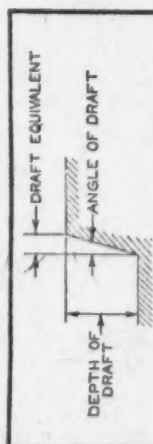
Based on data furnished by J. H. Williams & Co.

DROP-FORGING DATA FOR DRAFTSMEN AND DESIGNERS—2

MAKING DRAWINGS FOR DROP-FORGINGS

The ends of cylindrical sections are generally milled in the dies to create a spherical end-crown known as "radial draft." Such draft is depicted on drawings by swinging a radius equalling twice the diameter of the cylindrical protruding part, viz., $7/8$ inch radius for a $7/16$ inch diameter of cylindrical part. It is never so dimensioned, however. The same applies to half rounds.

Die Draft Equivalents



Depth of Draft	Angle of Draft		
	5 Deg.	7 Deg.	10 Deg.
1/32	0.0027	0.0038	0.0055
1/16	0.0055	0.0077	0.0110
3/32	0.0083	0.0115	0.0165
1/8	0.0109	0.0153	0.0220
5/32	0.0137	0.0192	0.0276
3/16	0.0164	0.0230	0.0331
7/32	0.0192	0.0269	0.0386
1/4	0.0219	0.0307	0.0441
9/32	0.0246	0.0345	0.0496
5/16	0.0273	0.0384	0.0551
11/32	0.0301	0.0423	0.0606
3/8	0.0328	0.0460	0.0661
13/32	0.0355	0.0499	0.0716
7/16	0.0383	0.0537	0.0771
15/32	0.0410	0.0576	0.0827
1/2	0.0438	0.0614	0.0882
9/16	0.0465	0.0651	0.0937
5/8	0.0493	0.0689	0.1002
11/16	0.0520	0.0727	0.1067
3/4	0.0548	0.0765	0.1132
13/16	0.0576	0.0803	0.1197
7/8	0.0604	0.0841	0.1262
1	0.0632	0.0879	0.1327

Interior and Exterior Draft

To prevent seizing or sticking of the hot steel in the impressions as it is squeezed into the various recesses and tends to chill or shrink, it is necessary to allow "draw" or "clearance," commonly known as "draft," on all walls or surfaces perpendicular to the forging plane. The standard draft angle is 7 degrees around all exterior surfaces.

Interior draft, such as holes in the forging (which form frustums of cones in the dies), should have a 10-degree draft.

Lesser exterior draft, such as 3 degrees and 5 degrees, is frequently permissible, but always at some increased cost of the forgings, because the dies fall more rapidly, and difficulties may be experienced by the hammerman in freeing the forgings from the dies. (See also table of Die Draft Equivalents.)

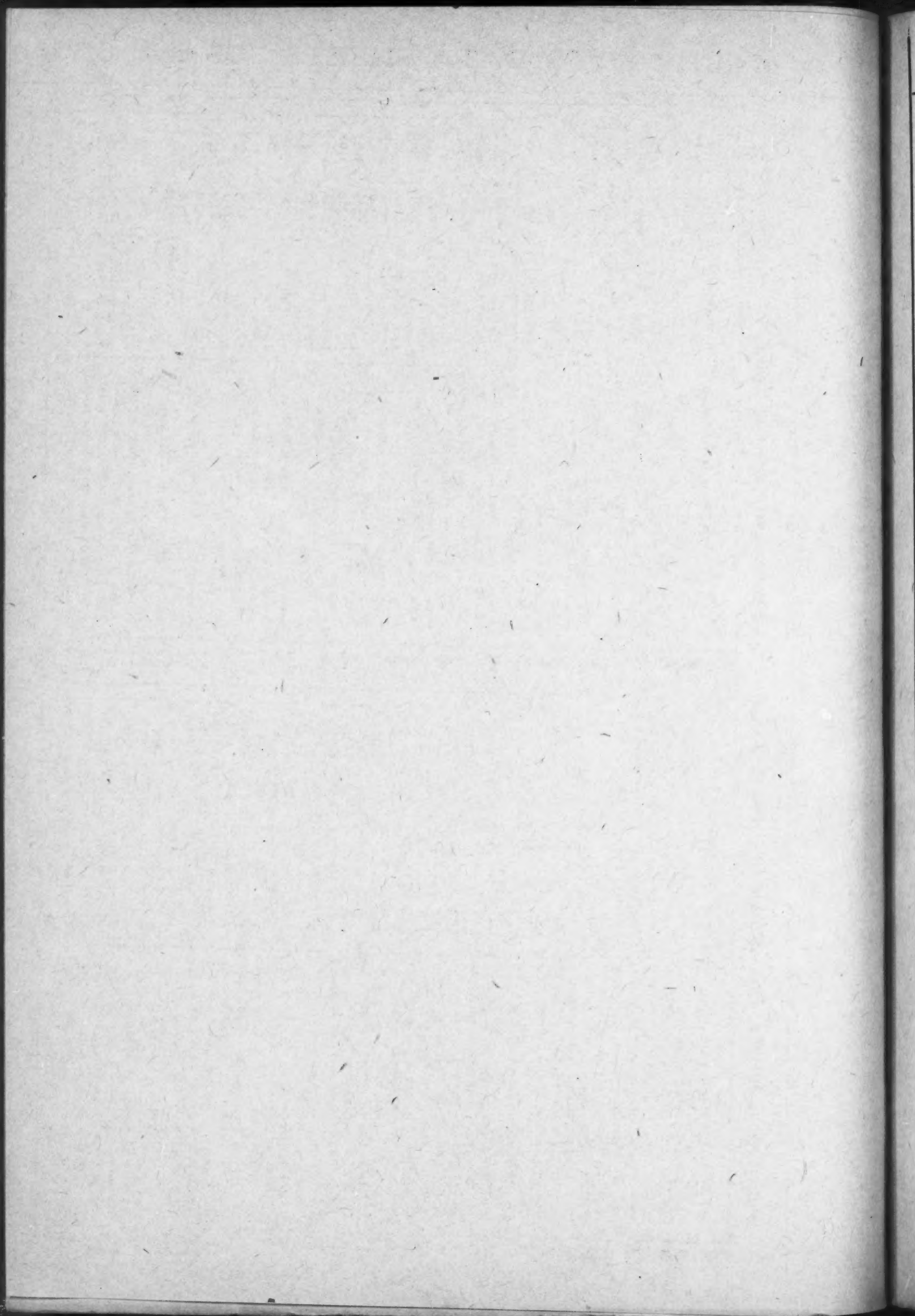
Stock for Finish

Surfaces of parts to be machined or ground should show or specify allowances for finish; usually $1/32$ to $1/16$ inch is allowed on a surface, but as little as $1/64$ inch may be allowed on

MACHINERY'S Data Sheet No. 360, New Series, December, 1937

Based on data furnished by J. H. Williams & Co.

MACHINERY, December, 1937—232-A



DROP-FORGING DATA FOR DRAFTSMEN AND DESIGNERS—3

MAKING DRAWINGS FOR DROP-FORGINGS

The forging operation produces a flash or surplus of thin waste all around the outline of the forging at the parting line, which is sheared or trimmed off close to the body by a hot or cold operation, leaving a trimming flat from 1/32 to 1/4 inch in width, depending upon size of piece, newness of dies, etc. Unavoidable variations in trimming may cause a very slight bulge or flash to remain. No special grinding or perfecting of this trimming line is included in the price when makers quote on commercial forgings. Whenever portions of the trimmed outline must be held very close to a size, the drawing should clearly specify this. Occasionally, it is feasible to shear off a large part of the draft protrusion by designing trimmers to cut into the body of the forging.

Forged Holes and Deep Recesses

Very narrow, deep depressions in the forging itself require narrow male protrusions in the dies, which do not stand up under the heat and pressure of the hot metal during forging. They must be judiciously moderated in depth, and have a minimum of 10 degrees draft, as well as be provided with good fillets. The depth of a depression or forged hole in either half-die should not exceed two-thirds of the least width of the depression.

Thin Ribs and Webs—Die Spread

Very thin ribs or webs on forgings should be avoided whenever possible, particularly on alloy steel forgings. Thicknesses of 3/32 to 1/8 inch or greater are preferable for best results and lowest cost.

Draft angles are subject to increase as the dies wear. For that reason, it is best to show all dimensions to points deepest in the die, and not over-all or to the parting line. If an over-all dimension is of vital importance, it should be emphasized by a suitable descriptive note.

Coin-Pressing

Coin-pressing of small and medium-sized forgings can be specified to advantage on bosses or similar projections to tolerances as close as 0.005 inch. This eliminates or lessens the need for expensive machining or grinding operations.

Matching

When the regular draft angles do not match at the parting line because of one die having a greater depth of draft than its mate, the draft in the shallow die is increased to meet that of the deep die.

Marking of Tolerances—Variations

Maximum permissible tolerances should be indicated wherever possible to assist the forging manufacturer in quoting accurately.

Drop-forgings are subject to a variation in thickness dimensions (all dimensions perpendicular to the forging plane) amounting to about 0.015 inch on very small forgings, and 3/16 inch on very large forgings.

The variation on the average small forging is 1/32 inch, which may be requested as (+ 1/32 inch — 0), or (+ 1/64 inch — 1/64 inch), or (+ 0 — 1/32 inch).

The lengths of forgings may vary as much as ± 0.003 inch per inch of length.

MACHINERY'S Data Sheet No. 361, New Series, January, 1938

Based on data furnished by J. H. Williams & Co.

DROP-FORGING DATA FOR DRAFTSMEN AND DESIGNERS—4

MAKING DRAWINGS FOR DROP-FORGINGS

Fillets on forgings should be as large as possible to assist the flow of hot metal and promote economical manufacture. Similarly, projecting corners or edges should best be nicely rounded, since very sharp corners tend to cause die checks or cracks and premature die failure. The usual radius on the corner of forgings is from 1/32 to 1/16 inch.

Parting Line

In order that a part be forgeable, it must lend itself to formation in two reciprocal dies, into the faces of which "half" impressions of the part are machined or "carved."

Consequently, the designer must decide on a "parting line" which establishes all the formation above the parting line as being sunk or formed in the face of one die-block, and the remainder in the companion die-block. Of course, the dies must not be hooked or interlocked with the piece to be forged in such a way as to prevent separating die from die or lifting the hot forging from either die. Intricate cores and undercuts, as in sand and die castings, are not feasible.

Locked Dies

While many pieces can be sunk in dies with flat faces, because the parting line is straight, the parting line may change from one level to another. This creates a "locked die," which means that the die faces which carry the impression are at different heights instead of in the same plane.

It is also necessary to decide on a "forging plane," since some pieces can

General Requirements

Drawings should preferably be made to full-size scale, and should give complete dimensions, radii, etc. Samples or models often help the die-sinker in making difficult dies.

Raised lettering, such as trademarks, part numbers, etc., can be made part of the forging. For this lettering, select any suitable area that lies approximately parallel to the forging plane.

Accurately placed drill spots of 105 to 120 degrees included angle can be provided in forgings on any surfaces approximately parallel to the forging plane. This aids in drilling and saves jigs.

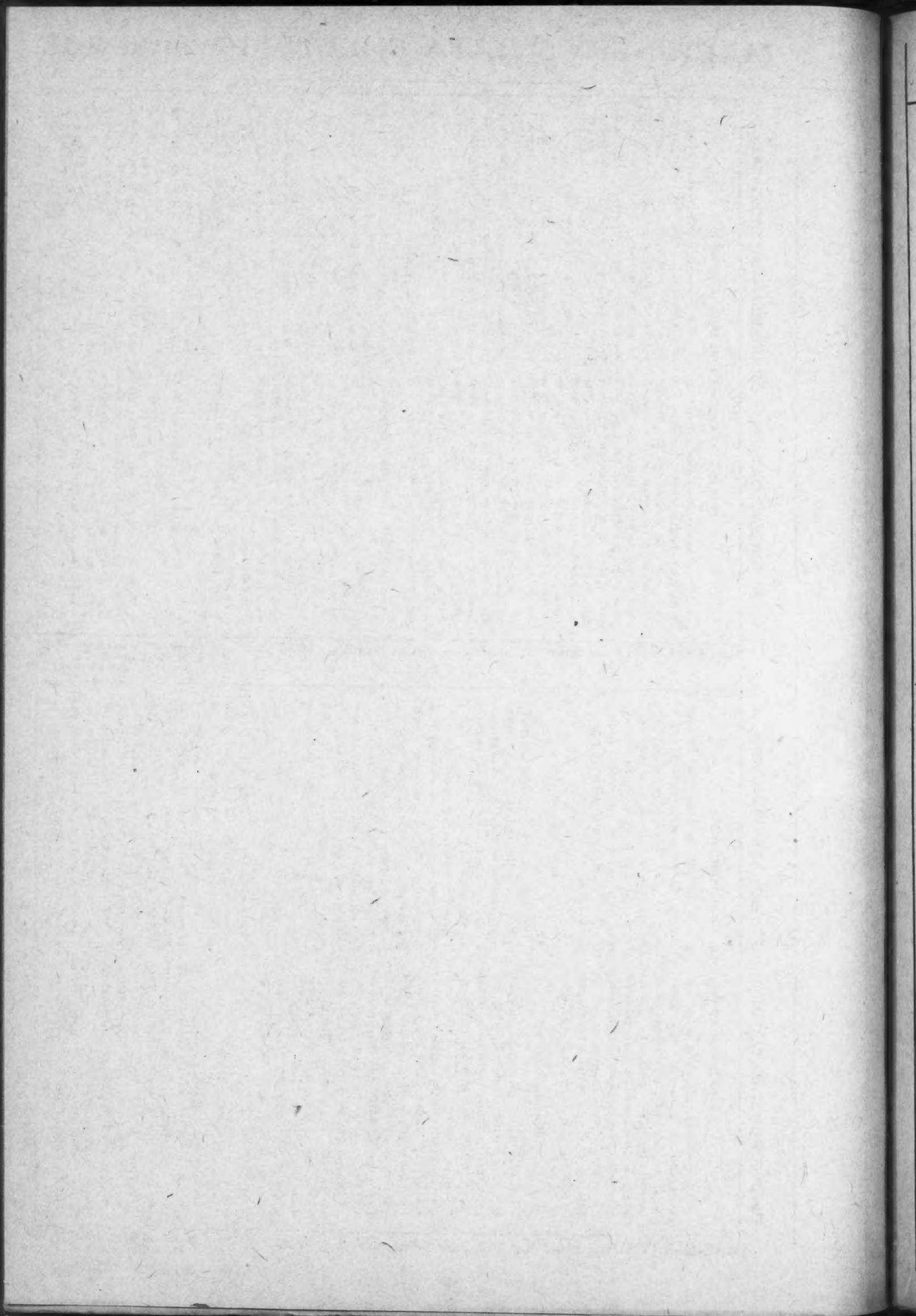
Lead Casts

Lead casts are generally submitted to customers for approval after completion of the dies and before actually making the forgings. These lead castings are obtained by casting molten lead in the finished die impression. Since the dies are made 3/16 inch per foot over size to allow for shrinkage of the forging, any dimensions that are held "locked" by the impression when the lead solidifies may measure 3/16 inch per foot over size. Lead casts are easily deformed and should be handled carefully.

MACHINERY'S Data Sheet No. 362, New Series, January, 1938

Based on data furnished by J. H. Williams & Co.

MACHINERY, January, 1938—296-A



MACHINERY'S DATA SHEETS 363 and 364

LOADS AND DEFLECTIONS OF HELICAL SPRINGS—1

Maximum Safe Load <i>P</i> , in Pounds, and Deflection <i>y</i> , in Inches per Coil, for Carbon Steel Round Wire Springs at 60,000 Pounds per Square Inch Fiber Stress*														
Outside Diameter of Spring, Inches	Diameter of Wire, Inches													
	0.014	0.016	0.018	0.020	0.022	0.024	0.026	0.028	0.030	0.032	0.034	0.036	0.038	0.040
1/8	0.493†	0.726	1.03	1.39	1.87	2.33	2.93	3.60	4.34	5.18	6.07	6.97	8.08	8.97
5/32	0.0123‡	0.0100	0.00840	0.00706	0.00612	0.00510	0.00437	0.00376	0.00323	0.00280	0.00241	0.00206	0.00179	0.00151
3/16	0.398	0.588	0.836	1.14	1.50	1.93	2.42	3.01	3.66	4.38	5.20	6.11	7.00	8.05
1/4	0.0209	0.0174	0.0147	0.0126	0.0108	0.00940	0.00822	0.00724	0.00634	0.00560	0.00497	0.00441	0.00390	0.00348
5/16	0.334	0.404	0.700	0.957	1.27	1.63	2.07	2.55	3.11	3.76	4.47	5.26	6.14	7.12
3/8	0.0319	0.0266	0.0227	0.0198	0.0171	0.0151	0.0134	0.0118	0.0105	0.00942	0.00850	0.00763	0.00690	0.00624
7/16	0.252	0.375	0.534	0.729	0.967	1.25	1.59	1.98	2.41	2.90	3.48	4.10	4.80	5.56
1	0.0606	0.0514	0.0445	0.0390	0.0343	0.0305	0.0272	0.0247	0.0222	0.0203	0.0184	0.0169	0.0154	0.0141
1 1/8	0.203	0.302	0.428	0.588	0.781	1.01	1.28	1.60	1.96	2.35	2.83	3.34	3.89	4.53
1 1/4	0.0990	0.0838	0.0730	0.0645	0.0572	0.0512	0.0461	0.0418	0.0381	0.0348	0.0321	0.0295	0.0271	0.0252
1 1/2	0.169	0.253	0.360	0.491	0.652	0.845	1.07	1.34	1.63	1.98	2.39	2.82	3.30	3.83
1 3/4	0.146	0.126	0.110	0.0965	0.0857	0.0774	0.0700	0.0638	0.0581	0.0533	0.0496	0.0458	0.0426	0.0395
2	.....	0.217	0.310	0.424	0.561	0.727	0.915	1.15	1.41	1.72	2.05	2.42	2.84	3.33
2 1/4	.....	0.174	0.153	0.135	0.119	0.109	0.0980	0.0903	0.0828	0.0765	0.0707	0.0654	0.0610	0.0574
2 1/2	.....	.....	0.271	0.371	0.493	0.638	0.810	1.01	1.24	1.50	1.82	2.14	2.52	2.91
2 3/4	.....	.....	0.203	0.180	0.161	0.146	0.132	0.122	0.112	0.103	0.0957	0.0891	0.0838	0.0778
3	.....	.....	.....	.....	0.396	0.512	0.652	0.813	1.00	1.21	1.45	1.71	2.00	2.35
3 1/4	.....	.....	.....	.....	0.259	0.236	0.215	0.198	0.182	0.168	0.157	0.146	0.136	0.129
3 1/2	.....	.....	.....	.....	.....	.....	.....	0.679	0.834	1.02	1.22	1.44	1.70	1.96
3 3/4	.....	.....	.....	.....	.....	.....	.....	0.292	0.270	0.252	0.234	0.219	0.206	0.193
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.869	1.04	1.24	1.46	1.70
4 1/4	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.348	0.325	0.305	0.287	0.271
4 1/2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.906	1.08	1.27	1.48
4 3/4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.442	0.406	0.382	0.360
5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.14	1.32
5 1/4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.490	0.463

*The values given are for severe service. For average and light service, multiply these values by 1.25 and 1.56, respectively. For rust-resisting steel, use 75 per cent of the values given, and for phosphor bronze, 50 per cent of the values.

†Maximum safe load *P*, in pounds
‡Deflection *y*, in inches per coil
Example—For a spring with an outside diameter of 1/2 inch, made from carbon steel wire 0.030 inch in diameter, read 0.371 pounds for load *P* in the upper line, and 0.180 inch for the deflection per coil *y* in the lower line.

MACHINERY'S Data Sheet No. 363, New Series, February, 1938

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

LOADS AND DEFLECTIONS OF HELICAL SPRINGS—2

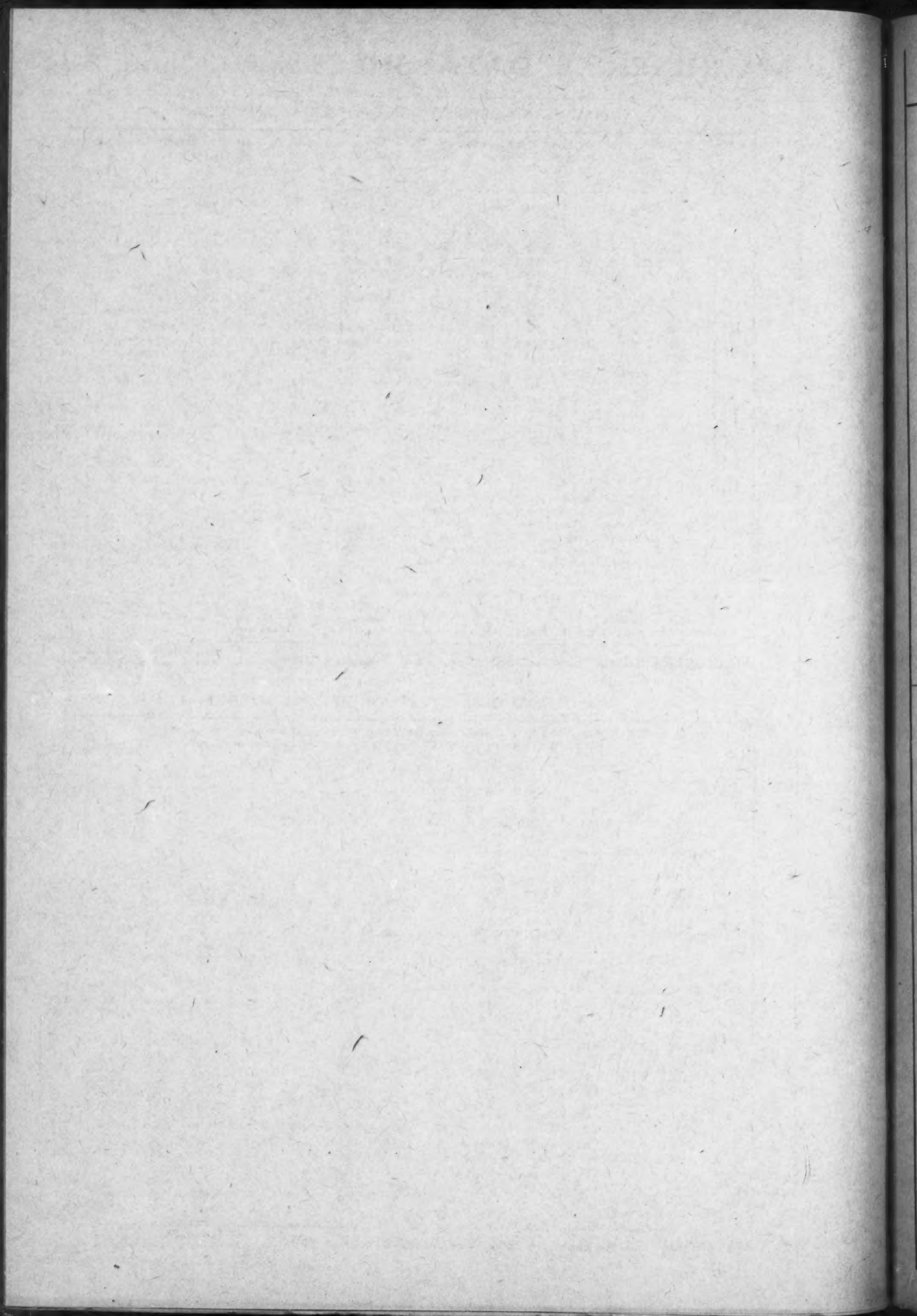
Maximum Safe Load <i>P</i> , in Pounds, and Deflection <i>y</i> , in Inches per Coil, for Carbon Steel Round Wire Springs at 60,000 Pounds per Square Inch Fiber Stress*														
Outside Diameter of Spring, Inches	Diameter of Wire, Inches													
	0.042	0.044	0.046	0.048	0.051	0.055	0.059	0.063	0.067	0.071	0.074	0.078	0.080	0.082
5/32	9.14	10.4	11.6	12.9	14.8	(Maximum Safe Load <i>P</i> , in Pounds)					.....	.....	.....	.....
3/16	0.00308	0.00273	0.00244	0.00216	0.00179	(Deflection <i>y</i> , in Inches per Coil)					.....	.....	.....	.....
1/4	8.12	9.15	10.4	11.7	13.6	16.5	19.6	.....	.....	.....	.....	.....	.....	.....
5/16	0.00563	0.00506	0.00465	0.00418	0.00359	0.00296	0.00242	.....	.....	.....	.....	.....	.....	.....
3/8	6.41	7.27	8.26	9.38	11.1	13.7	16.6	20.0	23.3	27.1	.....	.....	.....	.....
1/2	0.0130	0.0119	0.0110	0.0102	0.00907	0.00780	0.00670	0.00578	0.00498	0.00430	.....	.....	.....	.....
5/8	5.16	5.99	6.83	7.69	9.18	11.4	13.9	16.8	19.9	23.4	26.1	30.2	32.4	34.6
3/4	0.0231	0.0217	0.0202	0.0189	0.0171	0.0150	0.0131	0.0116	0.0103	0.00910	0.00831	0.00738	0.00698	0.00658
7/8	4.45	5.06	5.76	6.54	7.81	9.73	11.9	14.4	17.2	20.1	22.7	26.4	28.3	30.3
1	0.0370	0.0343	0.0321	0.0303	0.0276	0.0244	0.0218	0.0194	0.0175	0.0156	0.0146	0.0131	0.0125	0.0118
1 1/8	3.83	4.40	5.02	5.67	6.77	8.45	10.4	12.5	15.0	17.7	19.9	23.2	25.0	26.8
1 1/4	0.0536	0.0496	0.0468	0.0444	0.0405	0.0363	0.0326	0.0293	0.0266	0.0241	0.0224	0.0205	0.0196	0.0187
1 1/2	3.37	3.86	4.40	5.02	5.96	7.45	9.16	11.1	13.3	15.7	17.7	20.7	22.2	23.8
1 3/4	0.0732	0.0684	0.0646	0.0613	0.0560	0.0504	0.0456	0.0413	0.0376	0.0342	0.0321	0.0296	0.0282	0.0271
2	2.72	3.12	3.56	4.04	4.82	6.04	7.44	9.02	10.8	12.8	14.5	16.9	18.2	19.5
2 1/4	0.122	0.114	0.108	0.103	0.0947	0.0857	0.0788	0.0714	0.0656	0.0602	0.0565	0.0524	0.0504	0.0486
2 1/2	2.28	2.61	2.98	3.39	4.05	5.06	6.24	7.57	9.09	10.8	12.2	14.2	15.4	16.5
2 3/4	0.183	0.172	0.163	0.155	0.144	0.131	0.119	0.110	0.101	0.0932	0.0880	0.0820	0.0793	0.0766
3	1.95	2.25	2.56	2.92	3.48	4.36	5.38	6.51	7.85	9.29	10.5	12.3	13.2	14.3
3 1/4	0.255	0.241	0.229	0.217	0.202	0.184	0.169	0.156	0.144	0.134	0.127	0.118	0.114	0.111
3 1/2	1.72	1.97	2.25	2.56	3.06	3.83	4.72	5.73	6.88	8.18	9.25	10.8	11.7	12.5
3 3/4	0.341	0.322	0.306	0.292	0.272	0.248	0.228	0.210	0.195	0.182	0.172	0.161	0.156	0.151
4	1.53	1.75	2.01	2.27	2.72	3.42	4.21	5.12	6.13	7.29	8.25	9.67	10.4	11.2
4 1/4	0.438	0.414	0.395	0.375	0.351	0.321	0.296	0.274	0.253	0.236	0.224	0.210	0.204	0.198
4 1/2	1.38	1.58	1.81	2.05	2.46	3.08	3.80	4.62	5.54	6.59	7.45	8.72	9.40	10.1
4 3/4	0.548	0.520	0.494	0.472	0.440	0.405	0.372	0.345	0.319	0.298	0.284	0.266	0.258	0.250
5	.....	.....	1.64	1.88	2.24	2.80	3.46	4.21	5.06	6.01	6.78	7.94	8.56	9.22
5 1/4	.....	.....	0.605	0.578	0.540	0.495	0.465	0.423	0.394	0.369	0.349	0.329	0.318	0.310
5 1/2	.....	.....	.....	.....	2.06	2.57	3.17	3.86	4.64	5.50	6.24	7.29	7.85	8.45
5 3/4	.....	.....	.....	.....	0.650	0.596	0.550	0.510	0.476	0.444	0.424	0.398	0.386	0.375

*See Footnote on Data Sheet No. 363

MACHINERY'S Data Sheet No. 364, New Series, February, 1938

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

MACHINERY, February, 1938—360-A



MACHINERY'S DATA SHEETS 365 and 366

LOADS AND DEFLECTIONS OF HELICAL SPRINGS—3

Maximum Safe Load P , in Pounds, and Deflection y , in Inches per Coil, for Carbon Steel Round Wire Springs at 55,000 Pounds per Square Inch Fiber Stress*											
Outside Diameter of Spring, Inches	Diameter of Wire, Inches						Maximum Safe Load P , in Pounds (Deflection y , in Inches per Coil)				
	0.086	0.090	0.0915	0.102	0.106	0.121					
5/16	35.7 0.00532	38.9 0.00474	42.1 0.00456	49.4 0.00552	55.2 0.00597	76.1 0.00409					
3/8	31.6 0.00981	34.6 0.00879	37.5 0.00856	45.1 0.0110	50.0 0.0101	70.7 0.00727					
7/16	28.1 0.0157	30.8 0.0143	33.4 0.0138	40.6 0.0166	45.3 0.0154	65.1 0.0116					
1/2	25.1 0.0229	27.6 0.0210	29.9 0.0205	36.6 0.0246	40.6 0.0231	58.9 0.0185					
5/8	20.6 0.0413	22.6 0.0384	24.6 0.0378	28.6 0.0459	31.9 0.0472	47.0 0.0382					
3/4	17.4 0.0652	19.2 0.0610	20.8 0.0594	24.8 0.0748	27.8 0.0700	40.9 0.0574					
7/8	15.0 0.0945	16.6 0.0889	18.1 0.0870	21.9 0.103	24.5 0.0974	36.1 0.0804					
1	13.2 0.130	14.6 0.122	15.9 0.119	19.6 0.146	21.9 0.139	32.5 0.108					
1 1/8	11.8 0.170	13.1 0.160	14.3 0.157	17.7 0.196	19.8 0.189	29.3 0.138					
1 1/4	10.7 0.216	11.8 0.204	12.9 0.200	16.2 0.248	18.1 0.236	26.8 0.173					
1 3/8	9.72 0.267	10.8 0.253	11.7 0.248	14.9 0.301	16.7 0.291	24.6 0.211					
1 1/2	8.95 0.325	9.92 0.307	10.8 0.301	13.7 0.360	15.4 0.353	22.8 0.254					
1 5/8	8.26 0.387	9.16 0.366	9.96 0.360	12.8 0.423	14.3 0.412	21.2 0.300					
1 3/4	7.70 0.456	8.52 0.432	9.26 0.423	11.9 0.498	13.4 0.474	19.9 0.351					
1 7/8	7.19 0.528	7.96 0.501	8.66 0.491	11.2 0.565	12.6 0.542	18.7 0.404					
2	6.76 0.608	7.47 0.575	8.13 0.565	10.0 0.642	11.2 0.612	16.6 0.461					
2 1/4	6.00 0.782	6.66 0.742	7.25 0.728	9.02 0.808	10.1 0.771	15.0 0.662					
2 1/2	5.45 0.930	6.00 0.890	6.53 0.911	8.20 0.987	9.20 0.945	13.7 0.813					
2 3/4	5.00 1.14	5.45 1.09	5.89 1.06	7.47 0.982	8.47 0.932	12.6 0.777					
3	4.65 1.34	5.00 1.29	5.45 1.26	6.96 0.982	7.96 0.932	11.4 0.777					

*See Footnote on Data Sheet No. 363, February, 1938

MACHINERY'S Data Sheet No. 365, New Series, March, 1938

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

LOADS AND DEFLECTIONS OF HELICAL SPRINGS—4

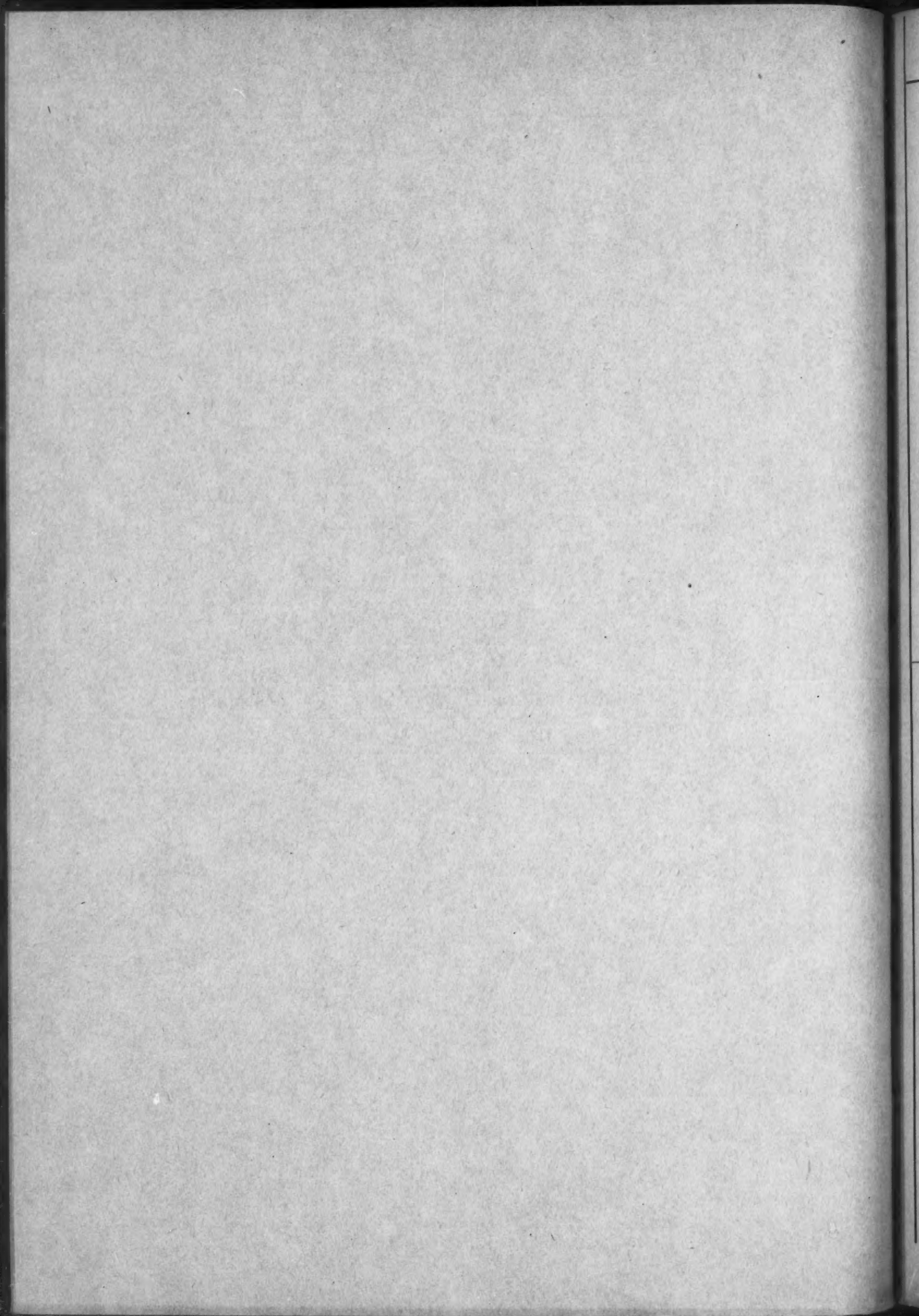
Maximum Safe Load P , in Pounds, and Deflection y , in Inches per Coil, for Carbon Steel Round Wire Springs at 48,000 Pounds per Square Inch Fiber Stress*											
Outside Diameter of Spring, Inches	Diameter of Wire, Inches					Outside Diameter of Spring, Inches	Diameter of Wire, Inches				
	0.207	0.225	0.263	0.283	0.307		0.381	0.363	0.394	0.430	0.460
1 1/8	135 0.0398	(Maximum Safe Load P , in Pounds) (Deflection y , in Inches per Coil)				1 3/4	307 0.0512	(Maximum Safe Load P , in Pounds) (Deflection y , in Inches per Coil)			
1 1/4	122 0.0531	156 0.0458	.....	.....	.....	1 7/8	289 0.0623	377 0.0526	.....	.....	.....
1 3/8	118 0.0687	144 0.0597	223 0.0450	.....	.....	2	274 0.0744	356 0.0631	451 0.0544	.....	.....
1 1/2	104 0.0861	132 0.0752	207 0.0576	256 0.0504	.....	2 1/4	247 0.102	323 0.0876	408 0.0759	522 0.0646	.....
1 5/8	96.8 0.105	124 0.0929	194 0.0721	239 0.0632	306 0.0548	2 1/2	224 0.134	294 0.116	372 0.101	478 0.0872	582 0.0772
1 3/4	90.4 0.127	115 0.112	181 0.0874	224 0.0774	282 0.0672	2 3/4	205 0.170	269 0.143	341 0.130	440 0.113	534 0.101
1 7/8	84.8 0.150	108 0.133	171 0.105	211 0.0930	267 0.0814	3	189 0.211	249 0.184	316 0.163	406 0.142	495 0.127
2	79.8 0.176	102 0.156	161 0.124	199 0.110	252 0.0965	3 1/2	164 0.305	215 0.268	274 0.239	353 0.210	431 0.190
2 1/4	71.3 0.232	91.3 0.208	144 0.166	179 0.149	227 0.131	4	144 0.416	189 0.368	241 0.329	313 0.292	381 0.265
2 1/2	64.4 0.298	82.6 0.266	131 0.215	162 0.193	206 0.171	4 1/2	129 0.546	170 0.484	216 0.434	279 0.386	341 0.352
2 3/4	58.9 0.370	75.4 0.332	119 0.269	143 0.243	188 0.217	5	116 0.691	153 0.616	195 0.555	252 0.494	308 0.452
3	54.2 0.451	69.3 0.406	110 0.331	137 0.299	173 0.267	5 1/2	106 0.856	140 0.764	178 0.693	231 0.617	282 0.564
3 1/2	46.6 0.636	59.7 0.576	94.8 0.471	118 0.428	150 0.385	6	97.4 1.04	128 0.927	164 0.838	212 0.752	259 0.690
4	.....	52.4 0.773	82.8 0.634	104 0.532	132 0.525						

*See Footnote on Data Sheet No. 363, February, 1938

MACHINERY'S Data Sheet No. 366, New Series, March, 1938

Compiled by J. I. Hommel
Westinghouse Electric & Mfg. Co.

MACHINERY, March, 1938—424-A



LOADS AND DEFLECTIONS OF HELICAL SPRINGS—5

Data Sheets Nos. 363 to 366, published in February and March MACHINERY, give the maximum safe load P , in pounds, and the deflection y , in inches per coil, for carbon steel round wire springs. These data sheets eliminate the need for using formulas for a wide range of sizes. The tables cover music wire gage sizes of wire up to 0.090 inch and the National Wire Gage sizes in diameters above 0.090 inch. The following formulas and table of constants may be used in determining the values for spring sizes not found in the tables.

The maximum safe load P , in pounds, is obtained by the formula,

$$P = \frac{\pi d^3 s}{16 r K_1}$$

and the deflection y , in inches per coil, by the formula,

$$y = \frac{4 \pi S d^4}{G d K_1}$$

in which

- s = safe fiber stress, pounds per square inch;
- G = modulus of elasticity in torsion (pounds per square inch) = 11,000,000 for carbon steel; 9,500,000 for rust resisting steel; and 6,000,000 for phosphor-bronze;
- d = wire diameter, inches;
- D = mean diameter of spring = outside diameter minus wire diameter;
- r = mean radius of spring = $\frac{D}{2}$;
- K_1 = Wahl factor = $\frac{4C-1}{4C-4} + \frac{0.615}{C}$ where $C = \frac{D}{d}$ (see accompanying table).

C	K_1	C	K_1	C	K_1
2.0	2.06	4.2	1.38	7.8	1.19
2.1	1.98	4.3	1.37	8.0	1.18
2.2	1.90	4.4	1.36	8.5	1.17
2.3	1.84	4.5	1.35	9.0	1.16
2.4	1.79	4.6	1.34	9.5	1.15
2.5	1.75	4.7	1.34	10.0	1.14
2.6	1.71	4.8	1.33	10.5	1.14
2.7	1.68	4.9	1.33	11.0	1.13
2.8	1.64	5.0	1.31	11.5	1.12
2.9	1.60	5.2	1.30	12.0	1.12
3.0	1.58	5.4	1.28	12.5	1.11
3.1	1.56	5.6	1.27	13.0	1.11
3.2	1.53	5.8	1.26	13.5	1.11
3.3	1.51	6.0	1.25	14.0	1.10
3.4	1.49	6.2	1.24	14.5	1.10
3.5	1.48	6.4	1.24	15.0	1.10
3.6	1.46	6.6	1.23	16.0	1.09
3.7	1.44	6.8	1.22	17.0	1.08
3.8	1.43	7.0	1.21	18.0	1.08
3.9	1.42	7.2	1.21	19.0	1.07
4.0	1.40	7.4	1.20	20.0	1.07
4.1	1.39	7.6	1.19	....	....

MACHINERY'S Data Sheet No. 367, New Series, April, 1938

Compiled by J. J. Hommel
Westinghouse Electric & Mfg. Co.

MACHINING NICKEL AND NICKEL ALLOYS

Depth of Cut, Inches	Feed, Inches	Cutting Speed, Feet per Minute for Turning*				
		Wrought Monel Nickel	Wrought K Monel (Unhardened)	Cast Nickel	Cast Monel	Cast H Monel
1/32	0.008	168	115	..	..	..
1/32	1/64	139	85	110	90	60
1/32	1/32	118	75	95	80	55
1/16	1/64	121	75	95	80	55
1/16	1/32	104	65	80	70	45
1/16	1/16	60	40	55	45	30
1/8	1/64	110	70	85	75	50
1/8	1/32	68	45	60	50	35
1/8	1/16	48	35	55	40	25
1/8	1/8	34	25	35	30	20
1/4	1/32	57	37	..	..	..
1/4	1/16	39	27	..	..	..
1/4	1/8	29	20	..	..	..
3/8	1/32	52	30	..	..	..
3/8	1/16	34	25	..	..	..
3/8	1/8	24	15	..	..	..
1/2	1/32	49	32	..	..	..
1/2	1/16	31	20	..	..	..
1/2	1/8	21	15	..	..	..

*The data in this table applies to dry cutting. If the work is properly lubricated, the speeds may be increased about 20 to 25 per cent.

Cutting Fluids Recommended for Nickel and Nickel Alloys†

Operation	Monel and Nickel	Inconel and K Monel
Rough turning	Dry or water soluble oil.	Dry or sulphurized oil
Finish turning	Water soluble oil	Sulphurized oil
Rough planing	Dry or water soluble oil.	Dry or sulphurized oil
Finish planing	Water soluble oil	Sulphurized oil
Shaping	Dry or water soluble oil.	Sulphurized oil
Milling	Sulphurized oil	Sulphurized oil
Drilling under 3/32 inch.	Turpentine or gasoline...	Turpentine or gasoline
Drilling 3/32 to 1/4 inch.	Lard oil	Sulphurized oil (cut)
Drilling over 1/4 inch....	Water soluble oil (Monel)	Sulphurized oil
Threading	Sulphurized oil (Nickel)	Sulphurized oil
Tapping	Sulphurized oil	Sulphurized oil
Boring	Sulphurized oil	Sulphurized oil
Reaming	Sulphurized oil	Sulphurized oil
Broaching	Sulphurized oil	Sulphurized oil
Cold sawing (Low-speed circular saw)	Sulphurized oil	Sulphurized oil
Cold sawing (Hack saw, etc.)	Sulphurized oil	Sulphurized oil
Grinding	Water soluble oil	Water soluble oil
	Water soluble oil	Water soluble oil

MACHINERY'S Data Sheet No. 368, New Series, April, 1938

Based upon data Compiled by Development and Research Division of the International Nickel Co., Inc.



MACHINERY'S DATA SHEETS 369 and 370

PROPERTIES OF THE CHEMICAL ELEMENTS—1

Temperatures below -190°C are on the Centigrade Thermodynamic Scale.
The atomic weights given constitute the complete list of the International Weights of 1937, as approved and reported by the Committee on Atomic Weights of the International Union of Chemistry. There is reason to believe that the following (unofficial) values may prove more nearly correct: Aluminum, 26.974; gallium, 69.74.

Atomic Number	Atomic Symbol	Name of Element	Melting Point, Deg. C	Atomic Weight	Atomic Number	Atomic Symbol	Name of Element	Melting Point, Deg. C	Atomic Weight
89	Ac	Actinium	*1600	.....	63	Eu	Europtium .....	.....	152.0
13	Al	Aluminum	660.0 ± 0.1	26.97	9	F	Fluorine	-223 ± 10	19.00
51	Sb	Antimony	630.5 ± 0.1	121.76	64	Gd	Gadolinium .....	.....	156.9
18	A	Argon	-189.3 ± 0.5	39.944	31	Ga	Gallium	29.78 ± 0.02	69.72
33	As	Arsenic	†814	74.91	32	Ge	Germanium	958 ± 10	72.60
56	Ba	Barium	704 ± 20	137.36	79	Au	Gold	1063.0 ± 0.0	197.2
4	Be	Beryllium	1280 ± 40	9.02	72	Hf	Hafnium	*1700	178.6
83	Bi	Bismuth	271.3 ± 0.1	209.00	2	He	Helium	‡-271.4 ± 0.2	4.002
5	B	Boron	2300 ± 300	10.82	67	Ho	Holmium .....	.....	163.5
35	Br	Bromine	-7.2 ± 0.2	79.916	1	H	Hydrogen	-259.2 ± 0.1	1.0078
48	Cd	Cadmium	320.9 ± 0.1	112.41			H ₂ (normal)	-259.2 ± 0.1	.....
20	Ca	Calcium	850 ± 20	40.08			HD	-256.5 ± 0.2	.....
6	C	Carbon	‡700 ± 100	12.01			D ₂ (normal)	-254.5 ± 0.2	.....
58	Ce	Cerium	600 ± 50	140.13	61	Il	Illinium .....	.....	.....
55	Cs	Cesium	28 ± 2	132.91	49	In	Indium	156.4 ± 0.1	114.76
17	Cl	Chlorine	-101 ± 2	35.457	53	I	Iodine	114 ± 1	126.92
24	Cr	Chromium	1800 ± 50	52.01	77	Ir	Iridium	2454 ± 3	193.1
27	Co	Cobalt	1490 ± 20	58.94	26	Fe	Iron	1535 ± 3	55.84
41	Cb	Columbium	2000 ± 50	92.91	36	Kr	Krypton	-157 ± 0.5	83.7
29	Cu	Copper	1083.0 ± 0.1	63.57	57	La	Lanthanum	826 ± 5	138.92
66	Dy	Dysprosium .....	.....	162.46	82	Pb	Lead	327.4 ± 0.1	207.21
68	Er	Erbium .....	.....	167.64	3	Li	Lithium	186 ± 5	6.940

*Computed †At 36 atmospheres ‡At 30 atmospheres

MACHINERY'S Data Sheet No. 369, New Series, May, 1938

Based on Tables Published by the National Bureau of Standards

PROPERTIES OF THE CHEMICAL ELEMENTS—2

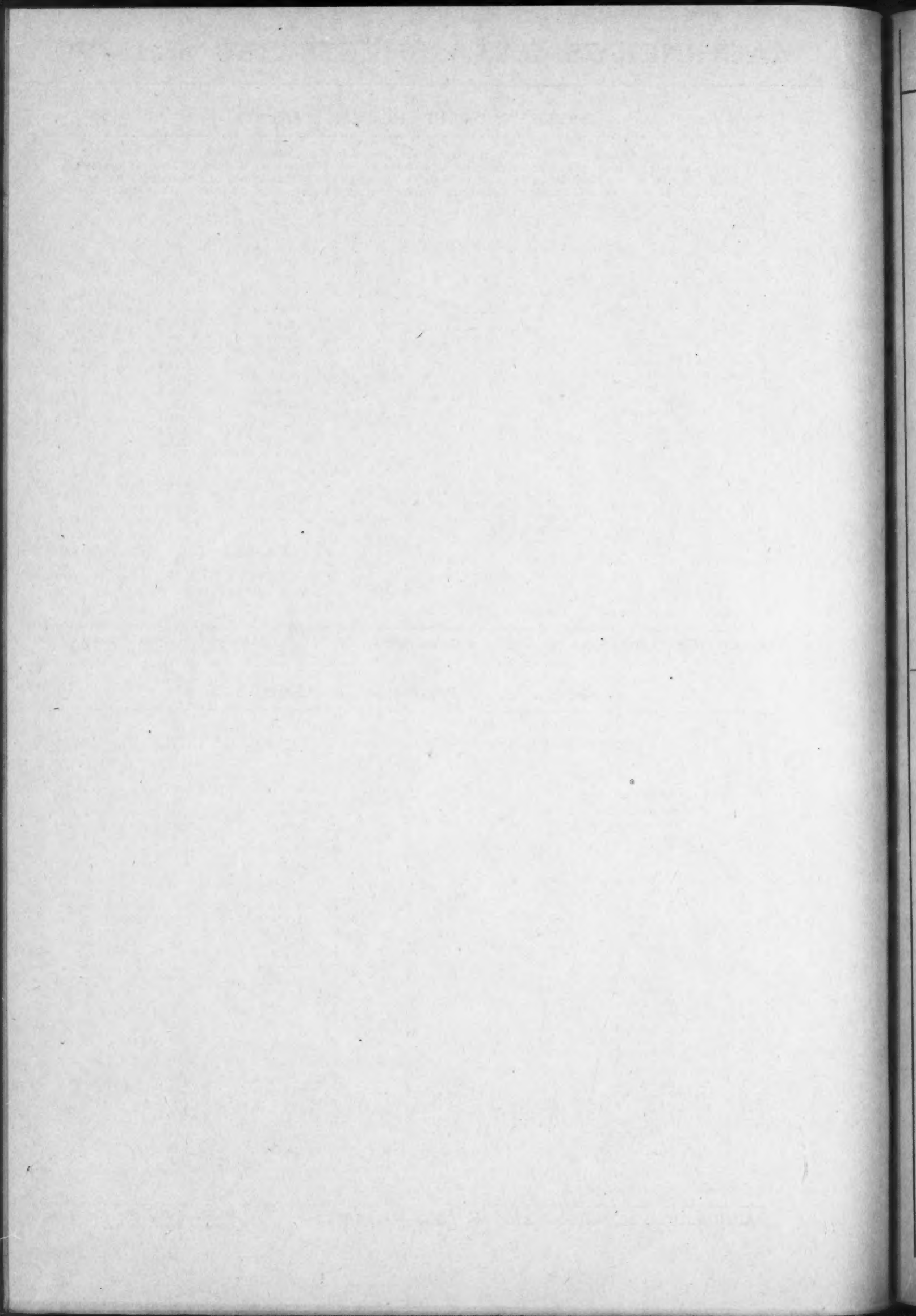
Atomic Number	Atomic Symbol	Name of Element	Melting Point, Deg. C	Atomic Weight	Atomic Number	Atomic Symbol	Name of Element	Melting Point, Deg. C	Atomic Weight
71	Lu	Lutecium .....	.....	175.0	21	Sc	Scandium	1200	45.10
12	Mg	Magnesium	650 ± 2	24.32	34	Se	Selenium	220 ± 5	78.96
25	Mn	Manganese	1260 ± 20	54.93	14	Si	Silicon	1430 ± 20	28.06
43	Ma	Masurium	*2700	.....	47	Ag	Silver	960.5 ± 0.0	107.880
80	Hg	Mercury	-38.87 ± 0.02	200.61	11	Na	Sodium	97.7 ± 0.2	22.997
42	Mo	Molybdenum ..	2625 ± 50	96.0	38	Sr	Strontium	770 ± 10	87.63
60	Nd	Neodymium ..	840 ± 40	144.27	16	S	Sulphur: Monoclinic ..	119.2 ± 0.2	.....
10	Ne	Neon	-248.6 ± 0.3	20.183			Rhombic	112.8 ± 0.2	.....
28	Ni	Nickel	1455 ± 1	58.69	73	Ta	Tantalum	3000 ± 100	180.88
7	N	Nitrogen	-210.0 ± 0.3	14.008	52	Te	Tellurium	450 ± 10	127.61
76	Os	Osmium	2700 ± 200	191.5	65	Tb	Terbium	327 ± 5	159.2
8	O	Oxygen	-218.3 ± 0.3	16.0000	81	Tl	Thallium	300 ± 3	204.39
46	Pd	Palladium	1554 ± 1	106.7	90	Th	Thorium	1800 ± 150	232.12
15	P	Phosphorus, Y..	44.1 ± 0.1	31.02	69	Tm	Thulium .....	.....	169.4
		Phosphorus, R..	†590	.....	50	Sn	Tin	231.9 ± 0.1	118.70
78	Pt	Platinum	1773.5 ± 1	195.23	22	Ti	Titanium	1820 ± 100	47.90
84	Po	Polonium	*600	.....	74	W	Tungsten	3410 ± 20	184.0
19	K	Potassium	63 ± 1	39.096	92	U	Uranium	*3600	238.07
59	Pr	Praseodymium ..	940 ± 50	140.92	23	V	Vanadium	1735 ± 50	50.95
91	Pa	Protactinium ..	*3000	231	54	Xe	Xenon	-112 ± 1	131.3
88	Ra	Radium	700	226.05	70	Yb	Ytterbium .....	.....	173.04
86	Rn	Radon	-71	222	39	Y	Yttrium	1490 ± 200	88.92
75	Re	Rhenium	*3000	186.31	30	Zn	Zinc	419.5 ± 0.1	65.38
45	Rh	Rhodium	1966 ± 3	102.91	40	Zr	Zirconium	1750 ± 700	91.22
37	Rb	Rubidium	39 ± 1	85.48	85	...	Element 85	*250	.....
44	Ru	Ruthenium	2500 ± 100	101.7	87	...	Element 87	*23	.....
62	Sm	Samarium	>1300	150.43					

*Computed †At 43 atmospheres

MACHINERY'S Data Sheet No. 370, New Series, May, 1938

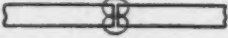



Based on Tables Published by the National Bureau of Standards

MACHINERY, May, 1938—590-A



MACHINERY'S DATA SHEETS 371 and 372




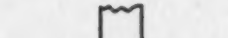
TYPES OF ARC-WELDED JOINTS AND THEIR APPLICATIONS—1

 <p>Plain Butt Joint</p>	<p><i>The Plain Butt Joint</i> is suitable for usual loading conditions. It requires full and complete fusion, particularly when the load is applied intermittently or subjects the joint to fatigue. The metal welded must be good weldable steel, since a large portion of it is melted during welding. This type of joint is generally used for plate 3/8</p>	<p>inch thick or less when a metal electrode is used in welding, and for 3/4-inch plate or lighter when the welding is done with a carbon electrode. Preparation for welding is simple, consisting only of matching or aligning the edges of the plate, leaving a space between the ends, the width of which depends upon the plate thickness.</p>
 <p>Single-vee Butt Joint</p>	<p><i>The Single-vee Butt Joint</i> is adapted for usual loading conditions. It is generally used when the plate thickness is considerably greater than that for which the plain butt joint is ordinarily used—that is, for plate 3/8 inch thick</p>	<p>or heavier, although it is also used for thinner plate. Preparation for this type of joint is more costly than for the plain butt type of joint, and more electrode material is required in welding.</p>
 <p>Double-vee Butt Joint</p>	<p><i>The Double-vee Butt Joint</i> is suitable for usual loading conditions. It is used for plates of greater thickness than those for which the single-vee butt joint is used, and for work that can be welded from both sides. The cost of preparation for welding is higher than</p>	<p>for the single-vee butt joint, but the double-vee butt joint requires approximately half as much electrode material. The cost of machining should be weighed against the cost of welding and the selection of the joint made accordingly.</p>
 <p>Single-U Butt Joint</p>	<p><i>The Single-U Butt Joint</i> is suitable for usual loading conditions and is used for work of the highest quality. This joint replaces the single- or double-vee joint for joining plates 1/2 to 3/4 inch thick, although it is occasionally used on heavier plate. For plates of this thickness, a single or double vee would</p>	<p>require a considerable amount of weld metal. Machining a single U on a plate reduces the amount of weld metal needed, but increases the machining cost. The joint is welded from one side, except for a single bead, which is applied last on the opposite side from the U.</p>

MACHINERY'S Data Sheet No. 371, New Series, June, 1938

Compiled by the Lincoln Electric Co.

TYPES OF ARC-WELDED JOINTS AND THEIR APPLICATIONS—2

 <p>Double-U Butt Joint</p>	<p><i>The Double-U Butt Joint</i> is suitable for all loading conditions, and is used for welding heavy plate 3/4 inch thick and thicker, where the welding can be done from both sides. This joint requires less weld metal than the single-U butt</p>	<p>joint, but costs more to machine. Choice between the double U and the double vee types should be made by comparing the relative machining and electrode costs and selecting the joint that costs less.</p>
 <p>Plain Tee Joint</p>	<p><i>The Plain Tee Joint</i> corresponds to the plain butt joint in that no machining of the plates is required. The plain tee joint is used for all ordinary plate thicknesses, principally for loads that place the weld in longitudinal shear. For severe impact or heavy transverse</p>	<p>loads, the non-uniform stress distribution of the joint should be kept in mind, and the stress intensity of the application given due consideration. The plain tee requires more weld metal, and therefore has a higher electrode cost than other tee joints</p>
 <p>Single-vee Tee Joint</p>	<p><i>The Single-vee Tee Joint</i> is suitable for much more severe loads than the plain tee joint, due to its better distribution of stress. It is employed in most instances for welding plates 1/2 inch thick or less, in work that can be</p>	<p>welded from one side only. While it is more costly to machine or prepare the plates for a single-vee tee joint than for the plain tee joint, the single vee type, on the other hand, is lower in electrode cost.</p>
 <p>Double-vee Tee Joint</p>	<p><i>The Double-vee Tee Joint</i> is suitable for heavy loads in longitudinal or transverse shear and for joining heavy plate where welding can be done from both sides. The double-vee tee joint</p>	<p>costs somewhat more to machine than the single-vee type of tee joint, but it has a lower electrode cost than some of the other types, such as the plain tee joint.</p>

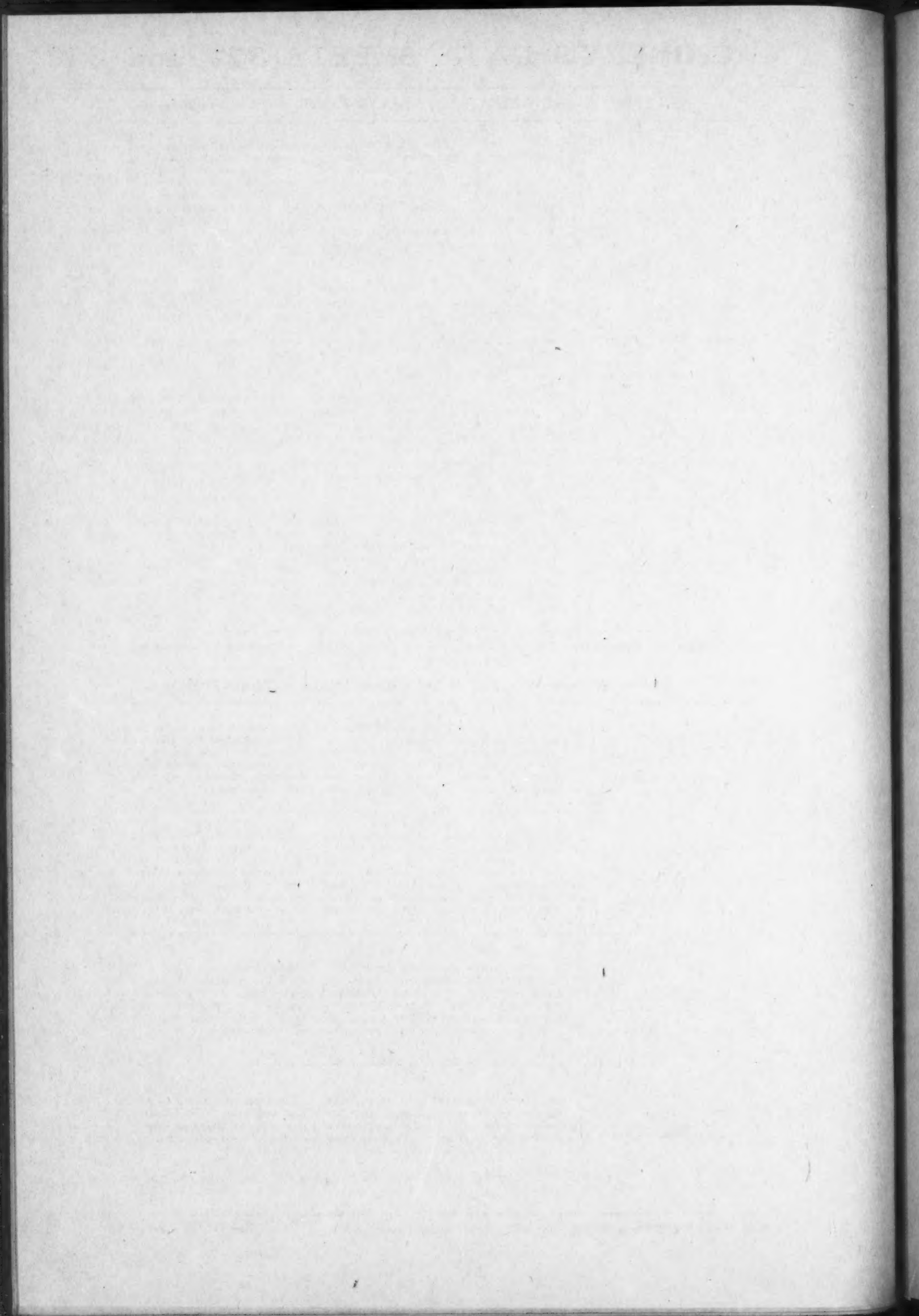
Additional examples of arc-welded joints will be shown in the July Data Sheet.

MACHINERY'S Data Sheet No. 372, New Series, June, 1938

Compiled by the Lincoln Electric Co.

MACHINERY, June, 1938—666-A





MACHINERY'S DATA SHEETS 375 and 376

PROPERTIES OF MEEHANITE CASTINGS—1
General Engineering Castings*

Grade of Meehanite	Tensile Strength, Pounds per Square Inch	Fatigue Strength, Pounds per Square Inch	Modulus of Elasticity	Coefficient of Friction, (Against Steel)	Transverse Strength		Compression Strength, Pounds per Square Inch	Brinell Hardness Number
					Load, in Pounds, Applied at Center of 18-inch Span of Test Bar 1.2 Inches in Diameter	Deflection, Inches		
G D	33,000 to 38,000	15,000	15,000 000	0.1695	2500	0.25	135,000	193
G C	38,000 to 42,000	17,500	17,000,000	0.1748	2800	0.28	150,000	207
G B	42,000 to 46,000	19,000	19,000,000	0.1853	3000	0.30	160,000	212
G A	50,000	23,000	21,000,000	0.1959	3500	0.35	175,000	223
G M	50,000 to 60,000	25,000	23,000,000	.....	3500	0.28	210,000	and up 241
G A H	More than 70,000	Over 28,000	28,000,000	.....	3800	0.45	250,000	and up 250 to 600

*The grades of Meehanite metal included in this table are recommended for castings used in general engineering work. The following notes supplement the data given in the table.

G D—Meehanite Grade G D metal is freely machineable and is recommended for pressure castings where the pressures run up to 250 pounds per square inch. It is also recommended for bearings, etc. Castings can be made in thicknesses of 1/8 inch and upward and to any size and weight. In structure, the graphite is dispersed in a manner to assure castings free from sponginess and segregation.

G C—This is a dense, easily machineable iron, showing a fine close grain on finishing cuts. It is recommended for a wide variety of high-quality castings and high-pressure work. Castings 3/16 inch thick and over can be made of this material.

G B—Grade G B is a general utility metal, combining exceptional tensile, toughness and impact

properties, together with excellent resistance to wear and a high damping capacity. It is unusually dense and is recommended for high-pressure work at temperatures up to 750 degrees F. This material can be used for castings having a sectional thickness of 1/4 inch and over. When heat-treated, the fatigue strength is 23,000 pounds per square inch.

G A—This metal has exceptional physical properties and can be used for castings 3/8 inch thick and over.

G M—The G M grade Meehanite is a super metal intended for special engineering castings. It may be oil-hardened with little or no distortion.

G A H—This grade is intended to be heat-treated. It may be oil- or water-hardened by a simple quench. Quenching and suitable drawing develops the physical properties given in the table. This is a high-strength metal showing little distortion on quenching. Castings are made 3/8 inch thick and over.

MACHINERY'S Data Sheet No. 375, New Series, August, 1938

Based on Compilations by the Meehanite Metal Corporation, Pittsburgh, Pa.

PROPERTIES OF MEEHANITE CASTINGS—2
Wear-Resisting Castings

W A Machineable

The tensile strength of this material is 50,000 pounds per square inch and the Brinell hardness, 196 to 321. This is a tough, dense, uniform-grained metal of high endurance limits, which makes it well adapted for applications involving hard wear and severe stresses. It also serves as a general material of engineering construction to replace cast steel. Typical installations are: Gears, brake-drums, cams, dies, sheaves, valves, truck wheels, valve bodies and plugs, crank and eccentric shafts, crane wheels and pinions.

W B C Chilled

The tensile strength of this base metal ranges up to 45,000 pounds per square inch and the Brinell hardness up to 550. Castings made of this material have a hard exterior which does not spall or chip and which is backed up by an exceedingly tough material interlocked with the chilled face. The depth and hardness of the chilled outer zone is adjusted to meet individual requirements, giving a resultant Brinell hardness up to 550. The chill carries dispersed colloidal graphite and the crystal grains are free from weakness. Typical installations are: Cement mill gears, rolls, and rollers, cams, sprockets, stamp mill dies and shoes, and toggle plates.

W B Non-Machineable

This material has a tensile strength of 38,000 pounds per square inch and a Brinell hardness of 350 to 550, according to requirements. It is a hard, dense metal with excellent wear-resisting properties which compare favorably with those of manganese steel, and is recommended for such parts as mill liners, sand-blast nozzles, crusher rings and segments, tube drills, pug-mill knives and blades, roll guides, pulverizing hammers, spike dies, trough liners, pump impellers, and other castings which encounter severe abrasive conditions. It does notpeen, warp, or distort.

W A H Heat-Treated

This material has a tensile strength of 70,000 pounds per square inch, is non-machineable above the 360 Brinell hardness number and has a Brinell hardness range of 200 to 500. This metal may be oil-quenched. A water-quench, however, gives a higher Brinell hardness. It can be machined before being hardened when used for such applications as bearing bushings, gears, liners, cams, etc., and gives exceptionally good wear-resisting properties.

MACHINERY'S Data Sheet No. 376, New Series, August, 1938

Based on Compilations by the Meehanite Metal Corporation, Pittsburgh, Pa.

CONVENIENCE

There's no expensive waste of effort or time with the Super-Service on the job! Bulletin R-24 explains the engineering which eliminates this great source of waste in radial drill operations. Send for your copy. There's no obligation.

Walking from spindle to column, from column to spindle, back and forth all day, to manipulate the various controls of the ordinary radial—these strollings and the climbing up and down on big jobs can total up to quite a parade—of waste! At times this waste amounts to as much as 80% of the total time. This doesn't happen with the Super-Service Radial because all controls are where they should be—at the head! Thirty-six selective spindle speeds. Eighteen feed changes. Rapid power traverse of head on arm. Power clamping of arm and column. All these controls on the Super-Service are at the head—low, within convenient arm's reach of the operator's normal working position.



**THE CINCINNATI
BICKFORD TOOL
COMPANY**
OAKLEY, CINCINNATI, OHIO

Classified Contents of this Number

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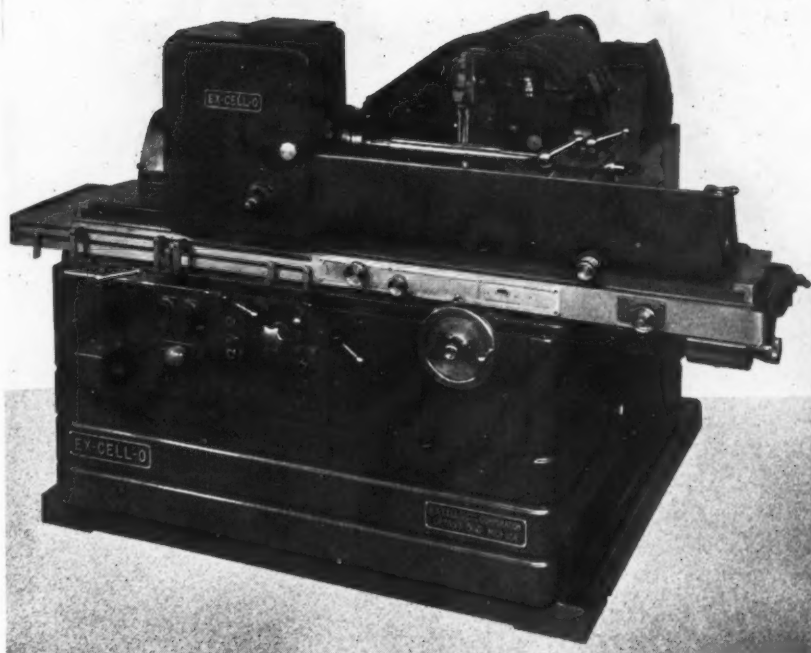
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Your Progress Depends Upon Your Knowledge of Your Industry



Universal Precision Thread Grinder, Ex-Cell-O Style No. 35. Self-contained, hydraulically operated and controlled, oil coolant type machine. (For high production runs on externally threaded parts of smaller size, Ex-Cell-O also offers a Style No. 31 Grinder.)

WIDE WORK RANGE *Combined* *with* HIGH PRODUCTIVITY

Without attachments, the Ex-Cell-O Style No. 35 Thread Grinder will produce these accurate threads: right and left hand; straight and tapered; with any pitch from 1 to 40 per inch; in U. S. Standard, sharp "V", 29 degree Acme, and modified Buttress thread forms.

This machine will produce most standard threads directly from solid, hardened blanks on a production basis; distortion caused by the heat treatment of previously rough cut threads will be corrected by finish thread grinding. Threads up to 12" in diameter, 22" long, can be ground on work up to 33" between centers. Longer shafts, up to 1 5/8" in diameter, are inserted in the hollow work spindle. With an attachment, internal threads can be ground on work from 1" to 8" inside diameter.

No other production threading method compares with grinding after hardening for accuracy of form, size and lead. Yet, such accurate threads are produced on the Ex-Cell-O Universal Precision Thread Grinder at a cost often lower than less precise methods.

FEATURES *of* OPERATION

● **WILL AUTOMATICALLY GRIND** to a predetermined size and then stop feeding, or stop at either end of table travel. Cross feed can be automatic or hand controlled. You grind in both directions, and automatically reverse at each end while still in the cut—without having an undercut at the end of the thread. An hydraulically operated backlash compensator is built in this machine.

● **HYDRAULICALLY OPERATED**, infinitely variable work speed spindle, not limited by steps, enables the maximum work speed to be used on each job—materially increasing the daily production from this Grinder.

● **THERE IS NO END PLAY** in the heavy duty grinding wheel spindle, because it runs in closely fitted Ex-Cell-O Precision Ball Bearings. The wheel is rapidly dressed, at grinding speed, semi-automatically. This aids in maintaining accurate thread form.

● **ACCURATE GRINDING** on a production basis under normal shop temperature change conditions, is made possible by a built-in lead compensator. Odd jobs with special leads, such as metric and diametral pitch, can also be ground.

● **PROVISION FOR GRINDING TAPERS** up to 2" per foot is built in.

● **INTERNAL ATTACHMENT**, easily installed on machines in the field, permits handling internally threaded parts. An external backoff attachment, also easily installed, enables the machine to grind straight and spiral fluted taps, chasers, etc.

EX-CELL-O

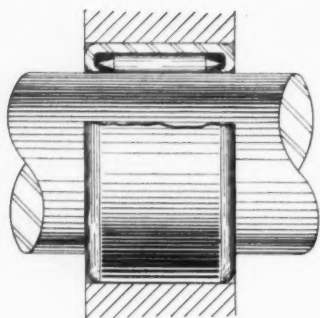
DRILL JIG BUSHINGS. GRINDING SPINDLES. HYDRAULIC POWER UNITS. PRECISION BORING AND FACING MACHINES. PRECISION THREAD GRINDERS. COUNTERBORES. BROACHES. CARBIDE TOOL GRINDERS. CARBOLY TIPPED TOOLS. SPECIAL HIGH PRODUCTION MACHINES. GROUND FORM TOOLS. PRECISION PARTS. MILLING CUTTERS

EX-CELL-O CORPORATION • 22 Oakman Blvd., Detroit, Mich.
Please send me, without obligation, your latest catalog on Precision Thread Grinders (Also, on the products I have checked at the left).

Name _____ Title _____
Company _____
Address _____

TORRINGTON NEEDLE BEARING DESIGN AND SERVICE FEATURES

BEARING TAKES HEAVY LOADS AT HIGH SPEEDS



Small Sizes Have High Capacity

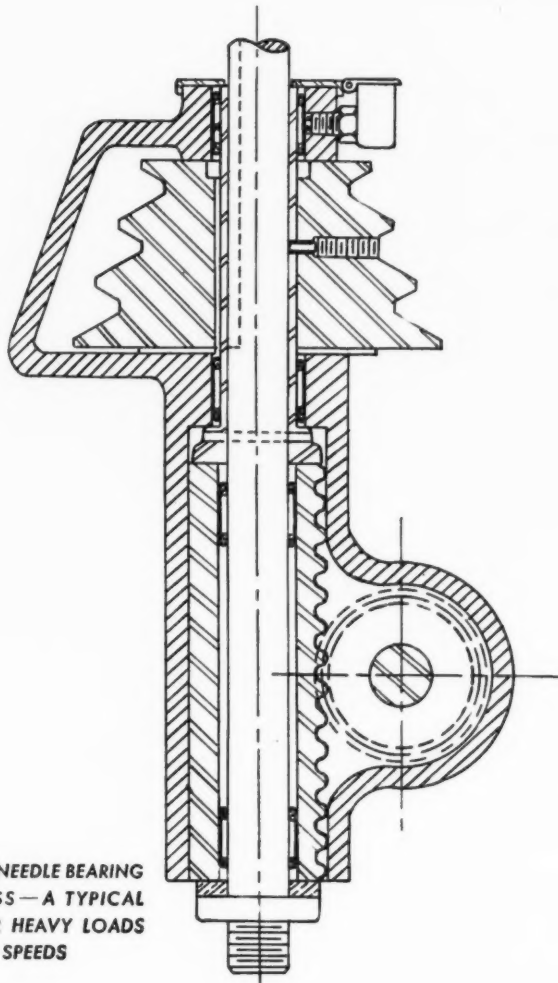
RADIAL LOAD capacity of the new Torrington Needle Bearing is an important advantage in high speed rotary applications such as the drill press illustrated. This application is typical of conditions where capacity for sudden heavy loads must be provided in a small space. The Needle Bearing, with its full complement of small diameter needles, is ideal for such applications.

Ease of lubrication of the Needle Bearing reduces the need of maintenance attention and keeps the bearing from becoming overheated. The turned-in lips of the hardened retaining shell provide a reservoir which holds an ample supply of lubricant for long periods of operation.

Simple Housing Design

The construction of the bearing—long axially and small in diameter—permits the use of the simplest type of housing design, with resulting economies in space and cost. The advantages of anti-friction construction can be utilized in a space comparable with that required by a simple bushing. Additional economies in production result from the bearing's low

58—MACHINERY, August, 1938



THE TORRINGTON NEEDLE BEARING
IN A DRILL PRESS—A TYPICAL
APPLICATION FOR HEAVY LOADS
AT HIGH SPEEDS

unit cost and the ease with which it is assembled in the housing.

Manufacturers interested in investigating the use of this unusual bearing in their products are invited to avail themselves of the experience of the Torrington Engineering Department in laying out bearing applications. Further

information is given in the Torrington Needle Bearing Catalog, available on request. Write for Catalog No. 11.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings
Branch Offices in all Principal Cities

**TORRINGTON
NEEDLE BEARING**

Here's further Proof that CARBOLOY TOOLS

Pay for themselves

FAST

(Usually before you
actually mail your
check)



This 7-Tool Set-up Paid For Itself In Exactly 13 $\frac{1}{3}$ Operating Hours!

Carboly tools last for months and frequently years of use BUT the pay-out period is measured in days and *hours*. In fact, under the usual terms of payment, most Carboly tools pay for themselves *before your check is actually mailed!*

Here's a typical example of this short pay-out period: On the 7-tool set-up shown above for machining a cast iron part, the tool investment was \$30.39. Through savings in tool cost, set-up time, grinding time and actual machining time, these seven tools paid for themselves in 13-1/3 operating hours.

In other words, a \$30.39 saving was made before the Carboly tools had barely started on the job! From then on these tools have paid a \$30.39 machining profit during every 13-1/3 hour period. This represents 6% interest on the original investment every 48 minutes—or \$727.64 profit every month

Management frowns at tool cost but smiles at dividends. Investigate Carboly tools—the rapid dividend-paying investment.

CARBOLOY COMPANY, INC.

DETROIT, MICHIGAN

CHICAGO • CLEVELAND • NEWARK • PHILADELPHIA • PITTSBURGH • STAMFORD, CONN. • WORCESTER, MASS.

Authorized Distributors:

Canadian General Electric Co., Ltd., Toronto, Canada

This \$30.39
Carboly Tool
Investment Pays
6% Interest
Every
48 Minutes
•
Saves \$727.64
Every Month!



Get the
FACTS about
Your Jobs

CARBOLOY
REG. U.S. PAT. OFF.
CEMENTED CARBIDE TOOLS

Carboly Co., Inc., 2987 E. Jefferson, Detroit, Mich.
Without obligation, furnish data on Carboly tools for the following machining operations:

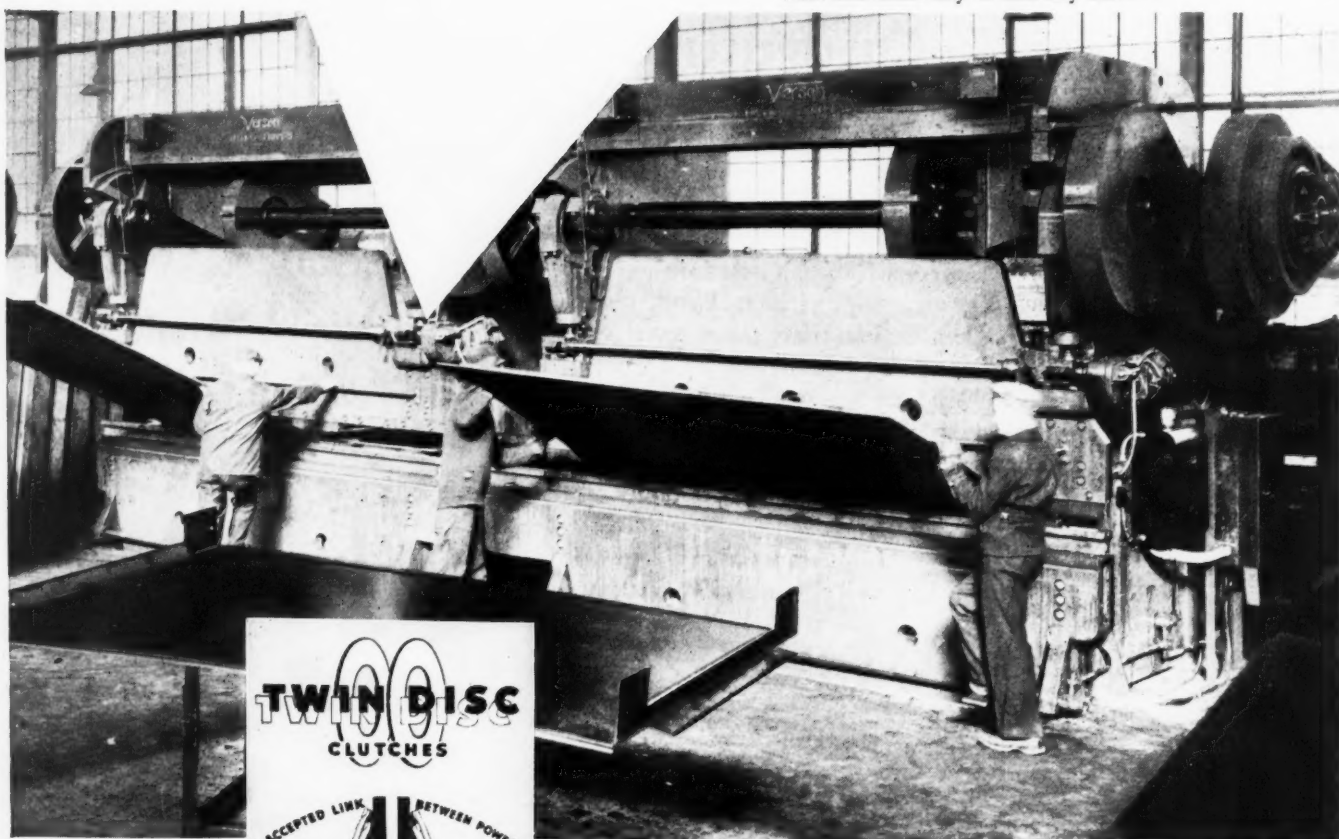
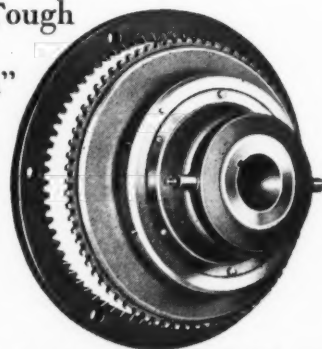
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Company _____
City _____ State _____

ABUSE IT *if you must!*

Twin Disc builds a clutch to fit the job
... not just to fit the machine. Tough
work ... sudden shocks ... the necessity "to ride the clutch"
... all are taken into consideration by Twin Disc engi-
neers and an "over and above" capacity built in
that provides an extra margin of safety.

That's why engineers say: "Twin Disc
Clutches seldom need service."

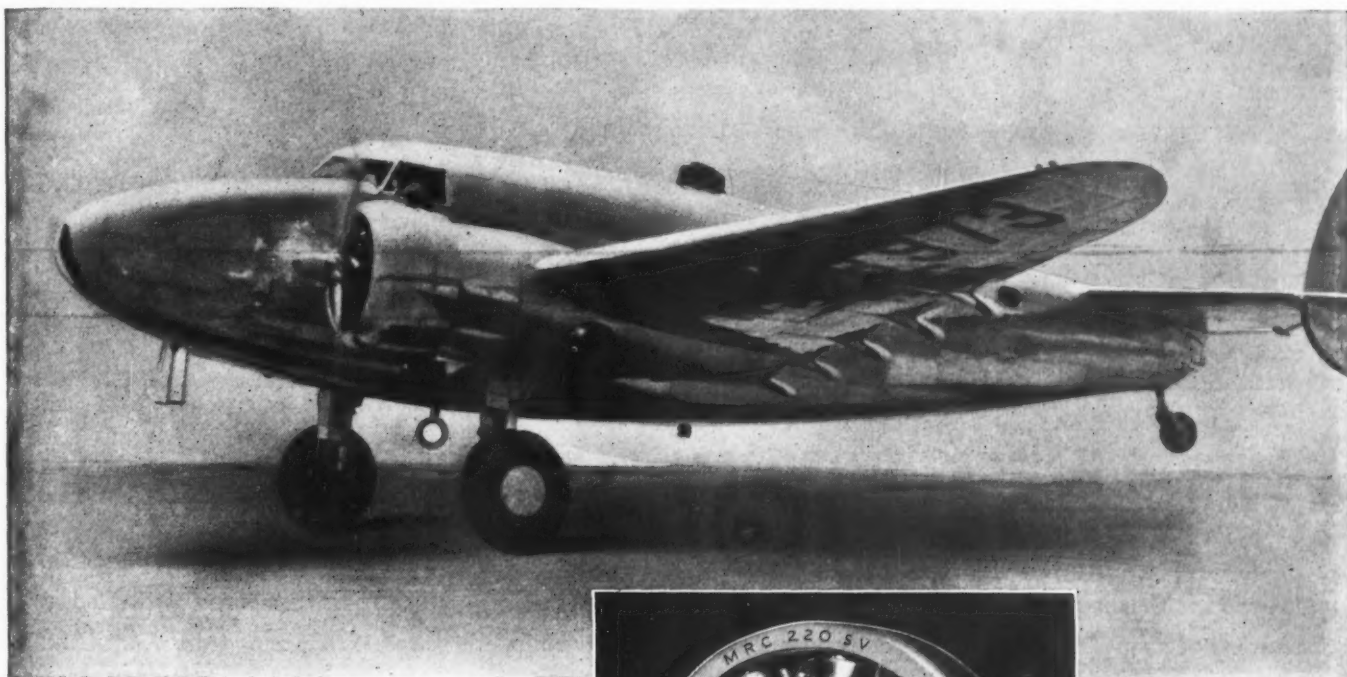
Says Verson Allsteel Press Company: "In our
opinion there is no machine which demands more
of a clutch than a press brake. Easing the ram up
to the work means *riding the clutch* and Twin Disc
Clutches have definitely shown to us their ability to
take *this abuse* day in and day out ..."



TWIN DISC CLUTCH COMPANY
1324 RACINE STREET, RACINE, WISCONSIN

Congratulations Howard Hughes, Lieut.
Thomas Thurlow, Richard Stoddart,
Harry Connors and Ed Lund!

*We are proud
That M-R-C Ball Bearings were used on your flight*



This record-breaking trip of 3 days, 19 hours and 16 minutes is a tribute to months of careful scientific preparation by Howard Hughes and his associates. M-R-C is proud to have contributed its uniform dependability under severe service conditions and again participated in aviation history.

MARLIN-ROCKWELL CORPORATION

Executive Offices: Jamestown, N. Y.

Factories at:

Jamestown, N. Y. and Plainville, Conn.



Wide World Photo

*M-R-C Ball Bearings
were used in the propeller
thrust location of the
Wright Cyclone engines
and in the Continental
Electric dynamotors for
radio equipment.*



M-R-C *Ball Bearings*
GURNEY • SRB • STROM

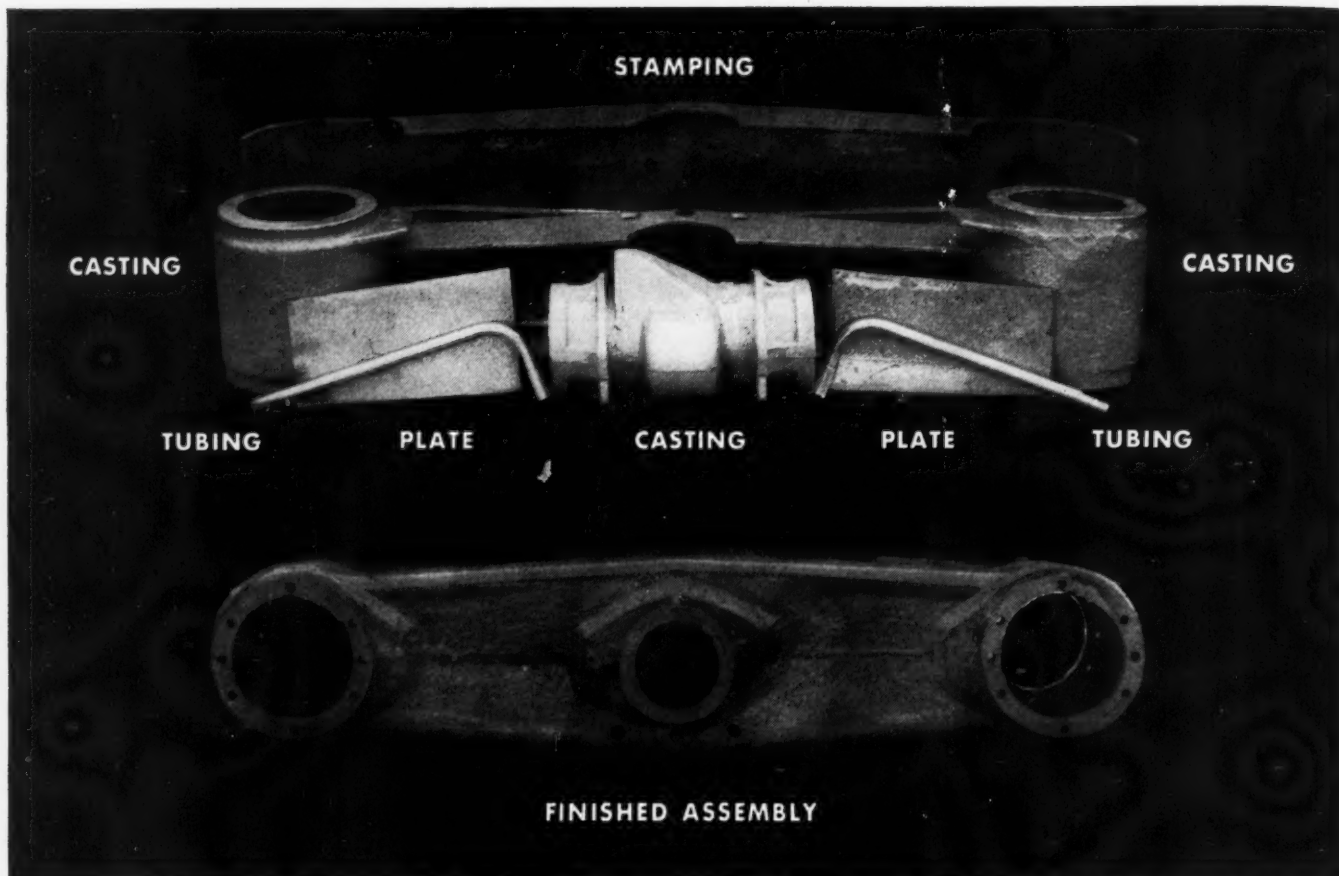


Photo courtesy Athey Truss Wheel Co., Chicago, Ill.

A WELDED DESIGN IS AN ALL-STAR COMBINATION

One of the chief advantages of welded steel construction is that it allows you to use in combination a variety of shapes and classes of steel to produce the best all-around design at minimum cost. You have your choice of standard shapes such as plates, bars, angles, channels, tubing, beams and sheets, and steel castings or stampings.

The welded steel rocker beam shown above illustrates this engineering freedom. The component parts consist of three steel castings (hubs), two pressed steel stampings (for the frame), two shear-

cut plates (reinforcements for frame sides) and two tubes (greasing fixtures). The parts are assembled in a positioning jig for easy handling and down-hand welding. Total welding time is 3 man-hours. The rocker beam has been tested to destruction and withstood a loading up to 105,000 lbs.

To help you take advantage of the opportunities of welded design, Lincoln offers a complete program of education, instruction and consultation service. Call a representative from the nearest Lincoln office and he will give you full particulars. Mail the coupon.

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

Largest Manufacturers of Arc Welding Equipment in the World

THE LINCOLN ELECTRIC CO.
Dept. B-516, Cleveland, Ohio

☐ Have your man call (no obligation). ☐ Send free copy of "How to Change Over to Welded Design."

Name _____ Position _____

Company _____

Address _____ State _____

City _____

MR. ROY W. SMITH, Supt., The E. W. Buschman Co., Cincinnati, Ohio. says—"To secure the lowest possible manufacturing cost, simplified design and speedy production, we are successfully applying arc welding to the fabrication of our conveying equipment."



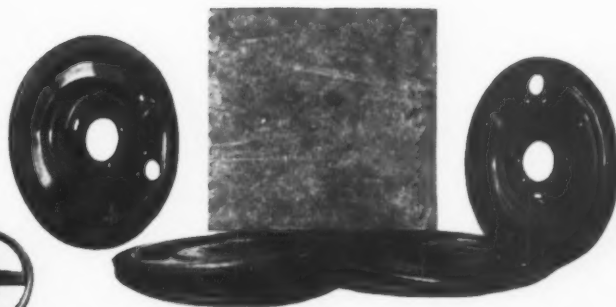
BUILT WITH YOUR METAL *Stamping* PROBLEMS in MIND

Every H-P-M Fastraverse Press provides the fundamental Hydro-Fower characteristics of production speed with hydraulic smoothness and flexibility . . is self-contained for independent operation . . and offers the maximum degree of control over the work. A typical example is the H-P-M Hydro-Power Fastraverse Press shown here, installed by a Mid-western manufacturer. Among the several jobs handled on this press is a dust seal plate for automotive hydraulic brakes. Made of 5/32" steel, they are drawn and coined at the rate of 300 per hour. For a general idea of the far-reaching application of H-P-M Fastraverse Presses to metal stamping problems, have an H-P-M Engineer call. • •

THE HYDRAULIC PRESS MANUFACTURING CO.

Mount Gilead • Ohio, U. S. A.

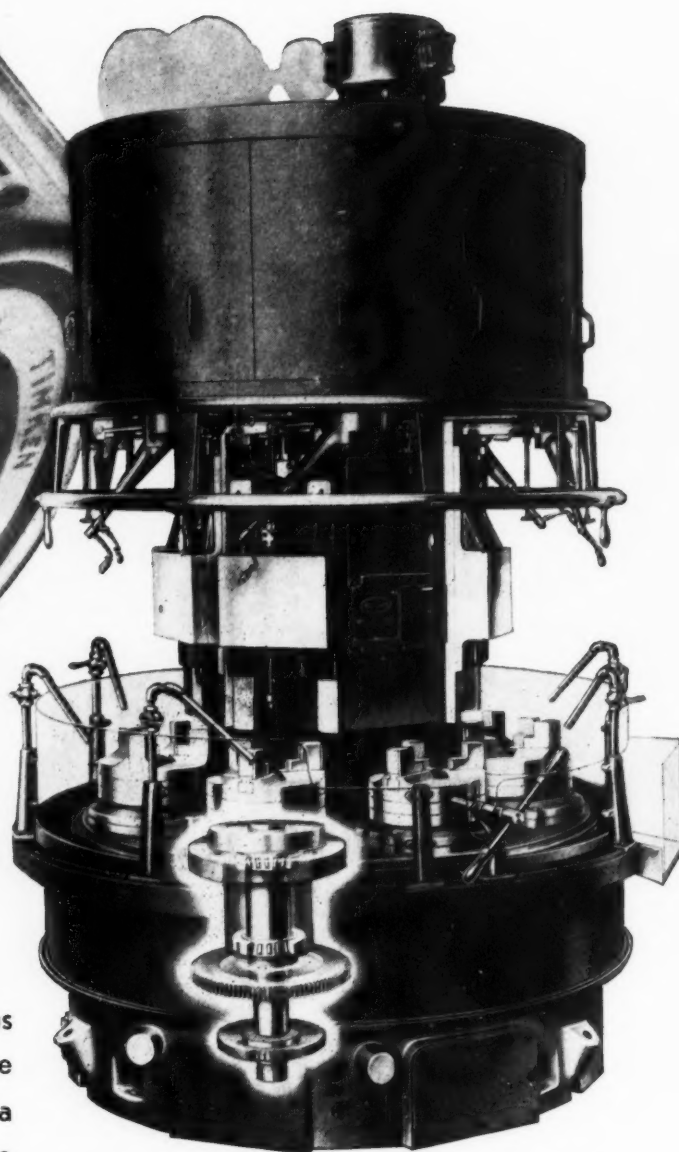
District Offices: New York, Detroit, Chicago
Representatives in Principal Cities



HYDRO POWER
FASTRAVERSE PRESSES

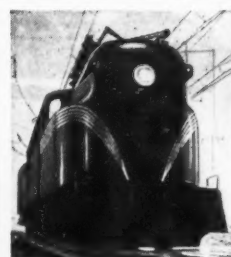


A symbol of quality for any piece of equipment with which it is associated



Bullard Type "D" Timken Bearing Equipped Multi-Au-Matic bores, turns, faces, threads, grooves and drills all classes of castings, forgings or cut off bar stock. Built in three sizes, each with 6 or 8 spindles.

The name of Bullard is one of the most famous in the field of heavy duty precision machine tools. When the Bullard Company designs a machine, outstanding performance can be taken for granted. They know from experience what factors are necessary to assure the extreme accuracy their equipment must have. Among these factors TIMKEN Tapered Roller Bearings have held a prominent place for 8 years. Thus, they are used on all work spindles of the Bullard Type "D" Multi-Au-Matic. Where such extremely fine tolerance limits must be maintained there is no place for vibration and chatter. The ability of TIMKEN Bearings to hold spindles rigid under every condition of speed, feed and cutting load has made them the dominant spindle bearings throughout the machine tool industry. It will pay you to have them on your new machine spindles.



The Pennsylvania's new Broadway Limited rolls on TIMKEN Bearings. GLIDE—as you ride a Timken Bearing Equipped train

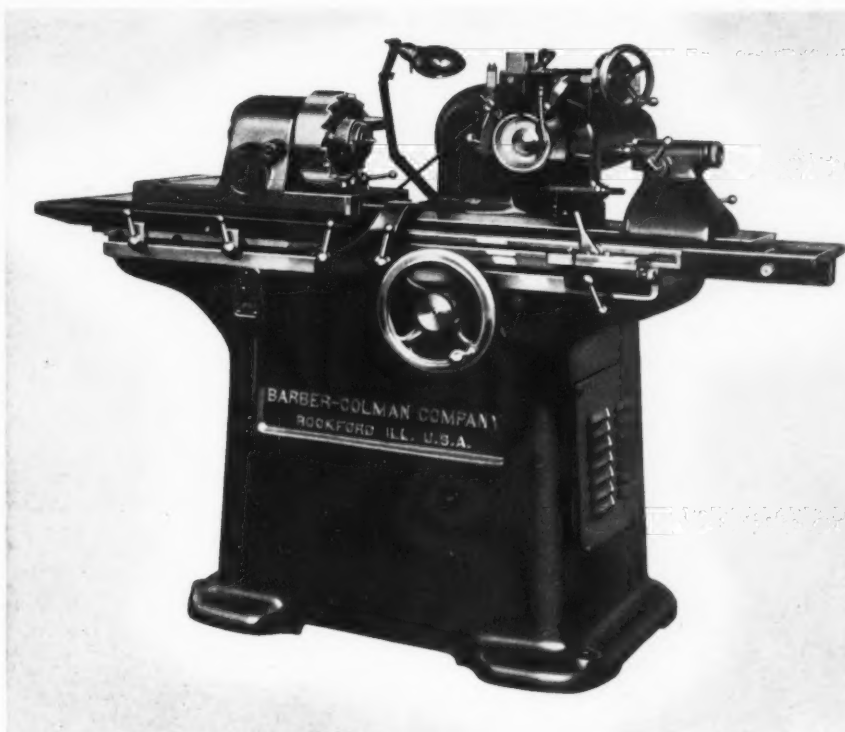
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
TAPERED ROLLER BEARINGS

GOOD NEWS!

About Sharpening Reamers, Hobs and Milling Cutters



ANNOUNCING
Barber - Colman
Combination
Sharpening
Machine

New **PRECISION**

New **SPEED**

New **CONVENIENCE**

Gone are the days of "by guess and by gosh" in sharpening Reamers, Hobs and Milling Cutters. The new Barber-Colman Combination Sharpening Machine gives remarkable new precision, new speed, new convenience, new economy. This machine is set up instead of "rigged up". It has a big, rigid, box-section base which provides a solid foundation for the machine elements. It gives *positive mechanical control* for all of the sharpening operations. It has self-compensating bearings on the spindle which automatically eliminate end play . . . affords diameter control in "tenths" . . . vernier adjustment of helix . . . unique accurate index, and many other advantages born of our Hob Sharpening Machines and Reamer Sharpening Machine, without their more costly specialized automatic features. For *any make* of Reamer, Hob or Milling Cutter, for diameters to 6" and 8"; stroke length, straight gash 24", highest spiral, 8"; regular or irregular spacings; odd numbers to 15, even numbers to 20. The Barber-Colman Combination Sharpening Machine is Good News for the Tool Room, for the men who supervise, the men who pay the bills. It is Big News, interesting and profitable. Write today for details. Ask for Bulletin 1486.

For sharpening reamers, hobs and milling cutters singly or in small lots, the machine shown above is ideal. For large volume sharpening of hobs, formed milling cutters and Barber-Colman Reamers our special automatic machines are unexcelled.



PRODUCTS
 MILLING CUTTERS,
 HOBS, HOBGING
 MACHINES, HOB
 SHARPENING MA-
 CHINES, REAMERS,
 REAMER SHARP-
 ENING MACHINES,
 SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant ROCKFORD, ILLINOIS, U. S. A.

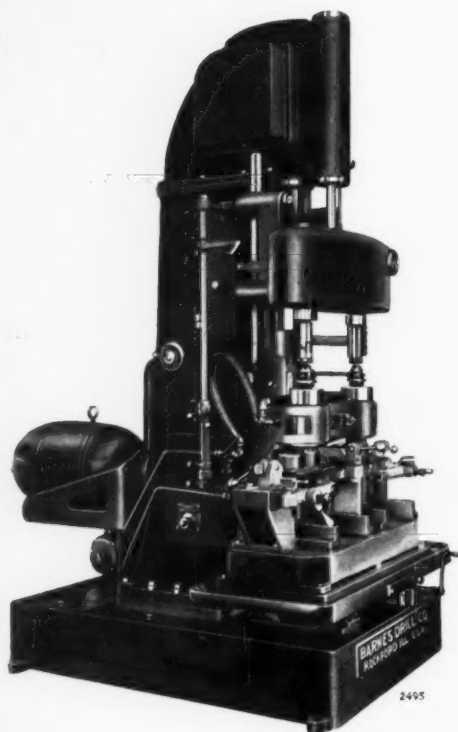
The machine illustrated in this advertisement is now available for distribution only in the United States of America.

MADE IN ROCKFORD, ILLINOIS, U. S. A.

Machinery - AUGUST 1938

Number 2610 Self-Oiling *All-Hydraulic* Honer

For Low-Cost Production on Husky Work



In accuracy, speed, high-quality finish, and economy there is no substitute for Internal Honing. For small, medium, or large honing; internal or external; there is no substitute or equal for our Honing Machines in complete range of sizes, number of highly successful installations, or versatility. Illustrated at left is our Number 2610 Internal Honer, and at right below a typical work-piece for which this machine is equipped to cut costs and increase production most effectively. Notable among the reasons for this is hydraulic rotation of the spindle; which provides a smooth powerful drive adjustable to any speed whatever in the range of the hydraulic unit, as indicated by a built-in tachometer. These newest features, our well known hydraulic reciprocation of the hone, other improvements, and patented features provide the means for securing quickly the exact combination of movements for greatest efficiency on any particular work-piece.

The same reasons which make Number 2610 so profitable on medium sized work apply equally well to our smaller and larger Vertical and Horizontal Honers. There is money for many in new uses of honing. Investigate! Write today for Bulletin 142.



Photo of twin cylinders 5 1/2" diameter by 15 15/16" overall counterbored 1 7/8" deep at top. Honed on No. 2610.

BARNES DRILL CO., 814 Chestnut St., Rockford, Illinois

PULLMORE CLUTCHES

Pullmore Multiple Disc Clutches have broad applications in machine tools, cranes, industrial trucks, printing, bookbinding, textile and similar automatic and semi-automatic machinery. They are used as main drive clutches carrying all the load; as auxiliary clutches controlling individual units; and in power take-off mechanisms to operate various attachments.

Pullmore Clutches engage smoothly; operate efficiently. They are reliable, compact, durable—provide years of satisfactory service, even under heavy-duty operating conditions. Complete data available in the Pullmore Blue Book. Write, today, for a copy.

ROCKFORD CLUTCHES

Rockford Clutches are ideal for use in tractors, agricultural machinery, cranes, street sweepers, road building, well digging, marine and similar equipment—wherever clutch control is desired for gasoline or diesel engines.

Rockford Clutches are made in two types — Spring-Loaded, which operates like an automobile clutch; and Over-Center, which remains in or out of engagement until the position of the operating lever or pedal is changed. Both types are efficient, durable, compact, easy to adjust—have ample take-up for long periods of heavy-duty service. Write us today for full information on these clutches.

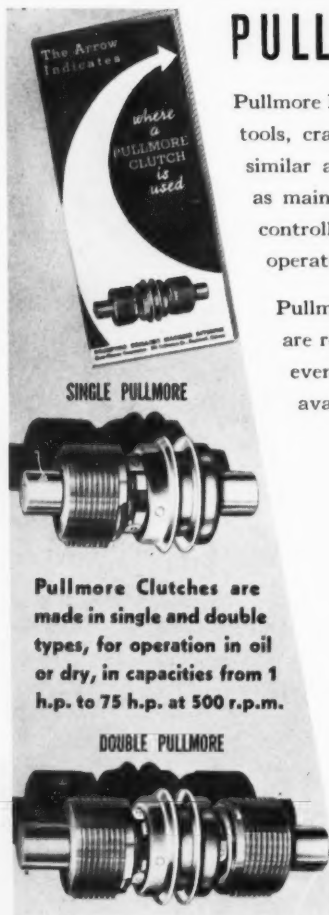
ROCKFORD DRILLING MACHINE DIVISION

of Borg-Warner Corporation

310 Catherine Street

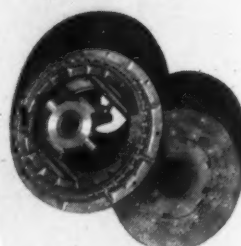
Rockford, Illinois

Pullmore Clutches sold by MORSE CHAIN CO., Ithaca, N. Y. With offices in principal cities.



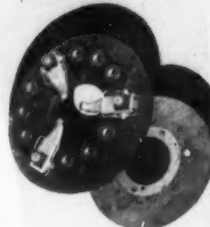
Pullmore Clutches are made in single and double types, for operation in oil or dry, in capacities from 1 h.p. to 75 h.p. at 500 r.p.m.

OVER-CENTER TYPE



Rockford Over-Center and Spring-Loaded Clutches are made with single or double drive plates, for operation in oil or dry, in capacities up to 80 h.p. at 100 r.p.m.

SPRING-LOADED TYPE



MADE IN ROCKFORD, ILLINOIS, U. S. A.

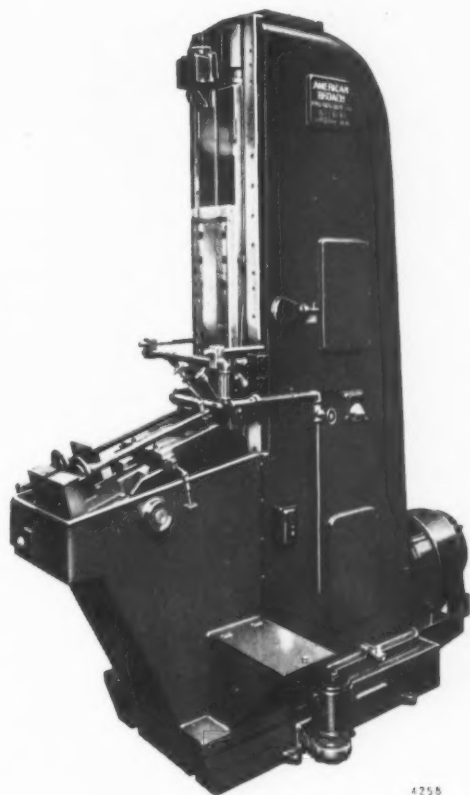
American Broaching

Gives High Production and Accuracy Easily



American Broaching Service is complete . . . has nation-wide representation . . . creates machines, broaches, fixtures, separately or as complete units, for any practical broaching operation.

The job . . . finishing automobile axles to length. The machine . . . American Surface Broaching Machine; rated stroke, 48"; rated tonnage, 10. The fixture . . . American, double, automatic tilting and clamping. Operator changes work-pieces on up-stroke of broach slide, and pushes button. As fixture tilts to horizontal, the two work-pieces are located accurately, clamped securely, and supported lightly at intermediate points to kill vibration; all of this being automatic. Now the two American broaches arrive on the down stroke to cut the $1\frac{5}{8}$ " diameter ends to length, removing about $\frac{5}{16}$ " of tough steel each in the process. Machine has characteristic American strength, rigidity, accuracy, compactness; smoothness, convenience, and economy of operation. Production on operation described is high. Machine can be used for much other work equally well. American Broaching Service has cut costs for many others, may do so for you . . . Investigate, today.



4255

AMERICAN BROACH & MACHINE COMPANY, Ann Arbor, Michigan, U. S. A.

BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY

Sundstrand Cuts Cost on Crankshafts



M1202

One operation on crankshaft shown at left requires removing about $\frac{3}{8}$ " of forged steel from both sides of middle portion. The special semi-automatic Rigidmil illustrated handles the job with speed and economy. Machine has steel base, two angular spindle heads, headstock and tailstock. Operating one air valve advances tailstock to support work-piece, clamps head end, moves spindle heads rapidly to cutting position where they latch securely. Two automatic roller steady rests support crankshaft each side of cut. Pushing a button starts rotation of work through 180° to automatic stop. Reversing air valve returns machine to starting position, releases work-piece for convenient removal. Operation is fast, easy, simple. Rigidmil is rugged, reliable, economical; increases former production more than 21%. Investigate Rigidmils and Stub Lathes.

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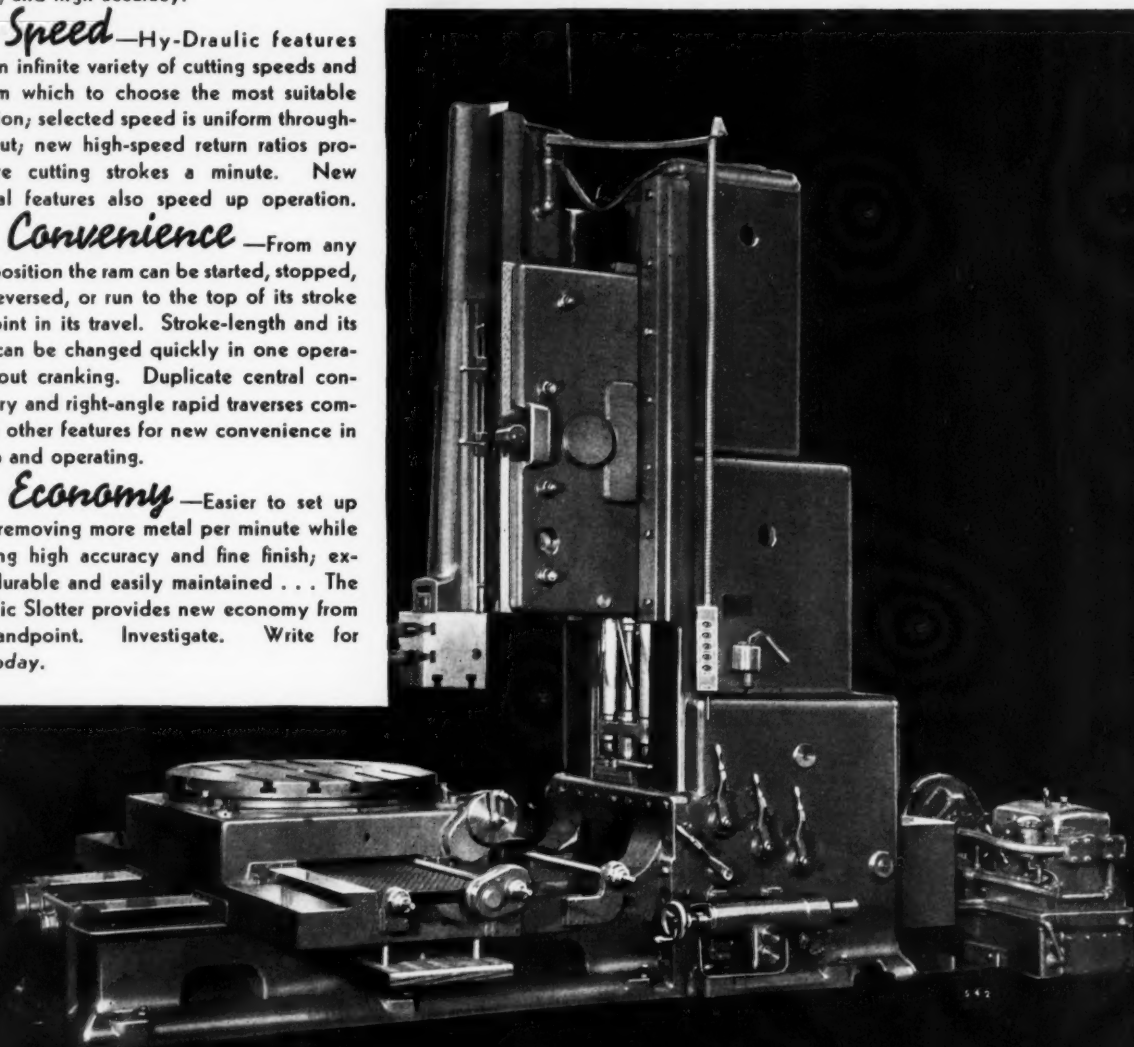
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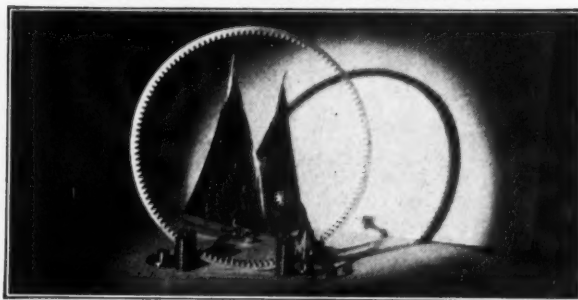
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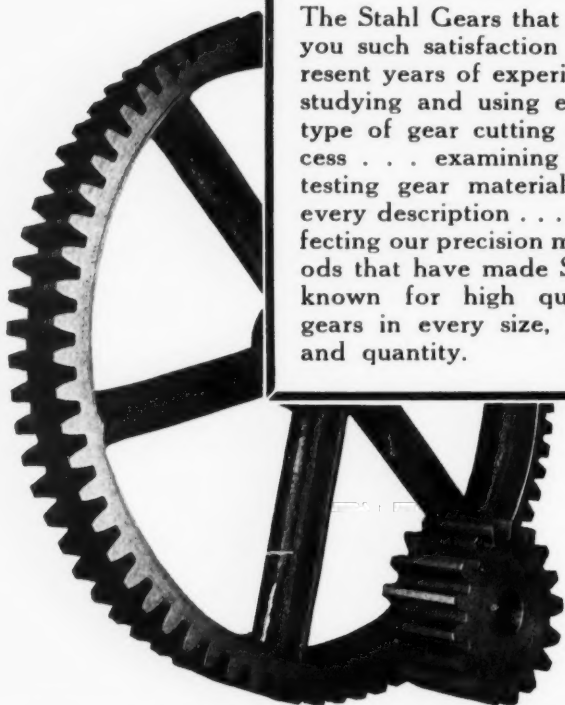
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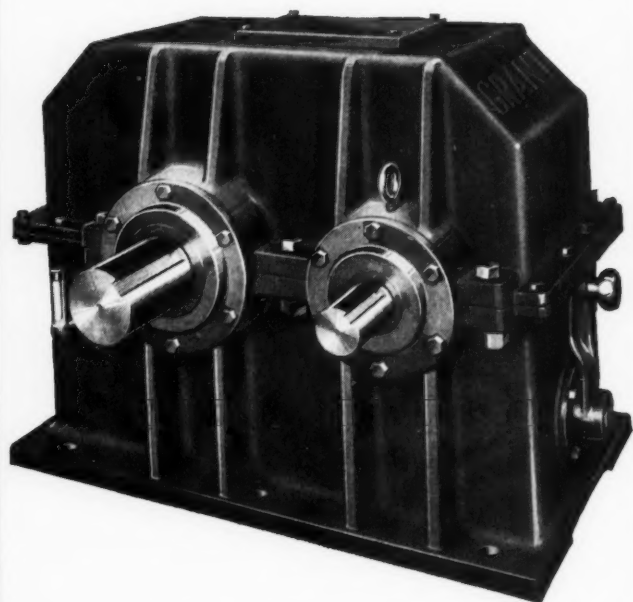
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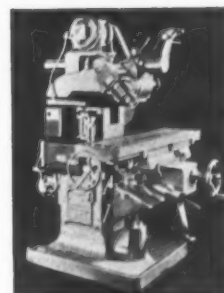
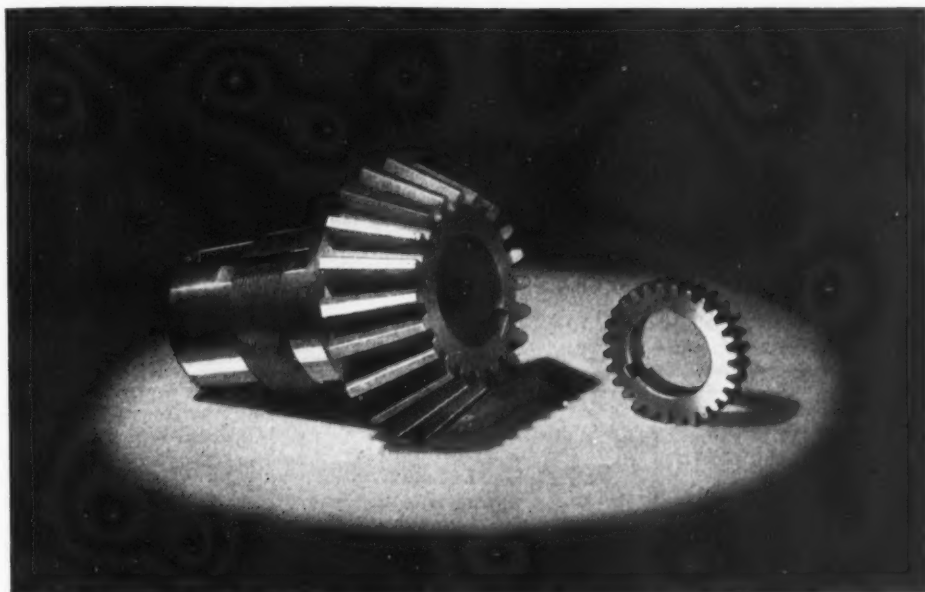


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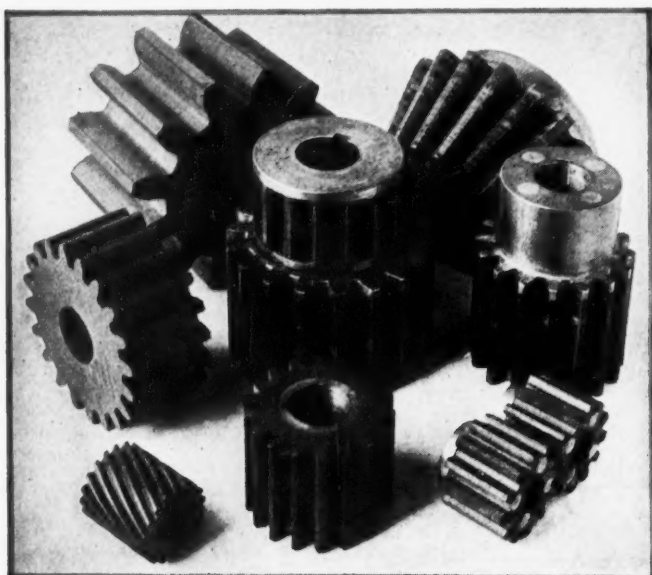
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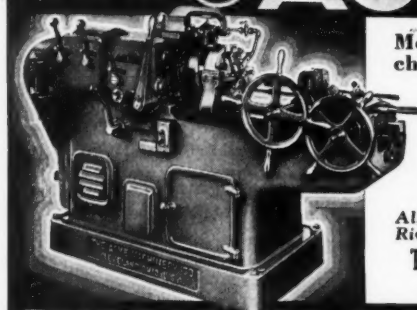
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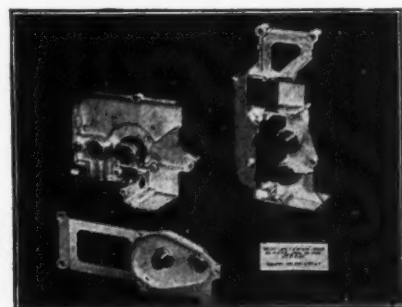
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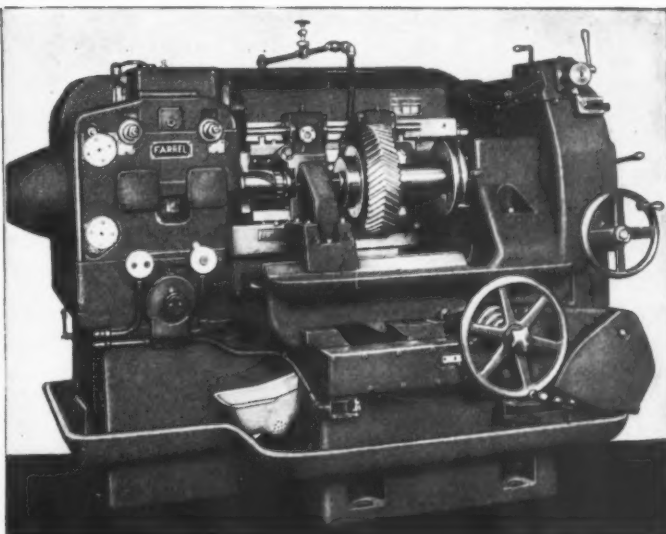
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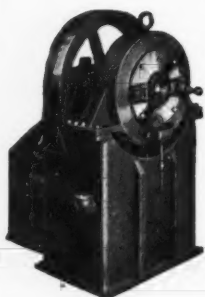
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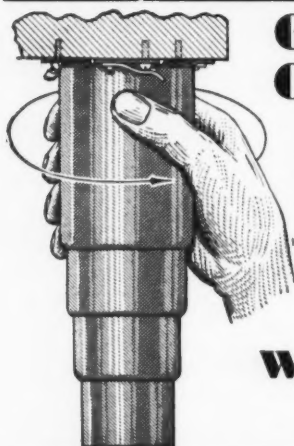
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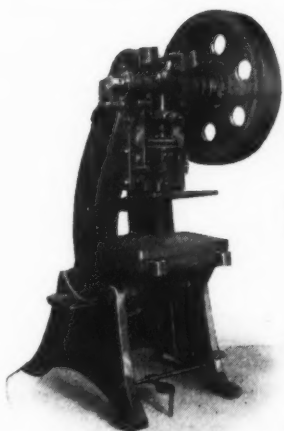
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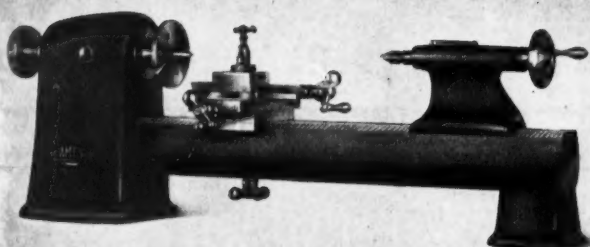
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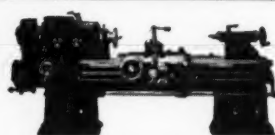
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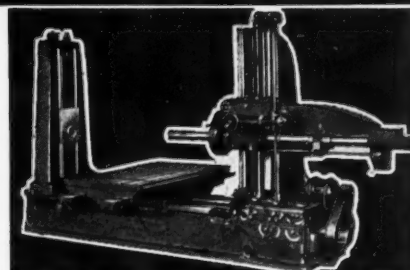
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Fig. 1334
Pat. Applied for.

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AUTOMATIC CENTERING REELS



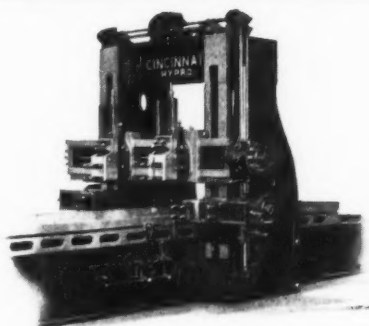
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Ask the MARVEL Sawing Engineer

Whether you are considering a small general purpose saw or a giant hydraulic capable of handling the largest sizes and toughest alloy steels—whether you have decided that a saw is the answer to your problem, or are just wondering if it might be, the MARVEL Sawing Engineer is the logical man to call in. MARVEL alone offers a complete System of metal sawing—incorporating a complete line of hack sawing machines and the composite MARVEL High-Speed-Edge blades which have changed all standards for practical sawing speeds, feed pressures and blade tensions.

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Low priced dry cutting utility shop saws.

A High Speed general purpose shop saw. All-Ball Bearing Heavy Duty High Speed Sawing Machines.

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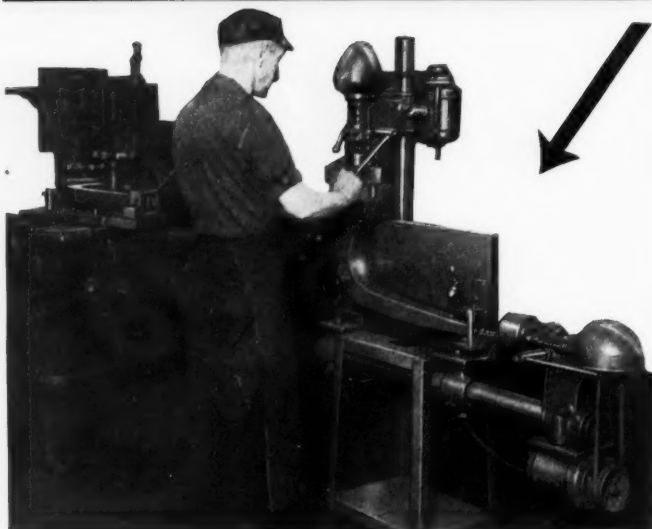
If you use metals in bars or billet form, a MARVEL Sawing Engineer will call at your request, analyze your sawing or cutting-off problems, and make recommendations covering sawing methods and equipment to fit your range of work and production requirements. This service is given without cost or obligation.

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This Operation Costs Nothing



HOW TO PUT IDLE TIME TO WORK

Photograph shows the milling and drilling of an overarm for a scroll saw. The operator loads the arm in the milling machine, starts the first cut, then loads a previously milled arm into the special drilling fixture set beside the milling machine and drills four holes in the arm. By the time this operation is completed the first cut is finished on the milling machine. While the second cut is being made, the operator transfers the drilled arm to another Delta drill and taps two holes. The drilling and tapping operations are done during the time that the operator would otherwise be idle—so these operations cost nothing for labor!

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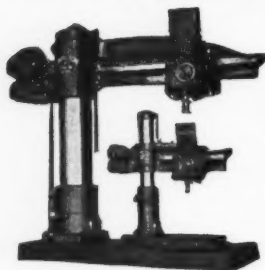
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Can be furnished in Column Diameters of 9", 11", 13", 15", 17", 19", 22" and 26" with arm lengths of 3', 4', 5', 6', 7', 8', 9', 10', 11' and 12'. With any style table, electric column binder, power traverse of head on arm and any style motor drive.

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24" — 26" — 28"

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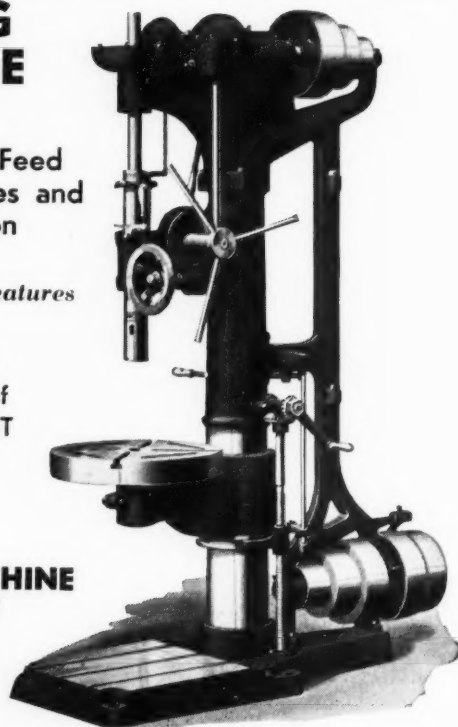
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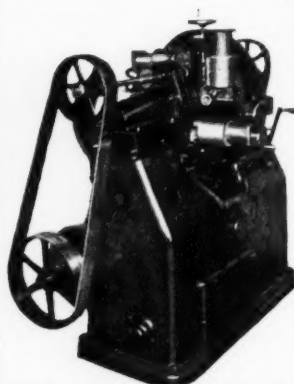
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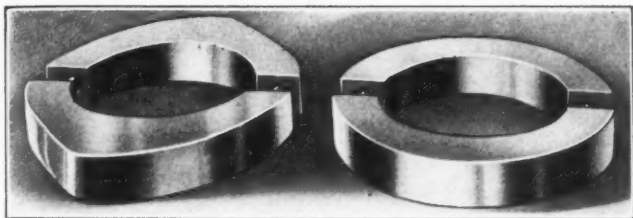
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Sizes 12" to 32" stroke

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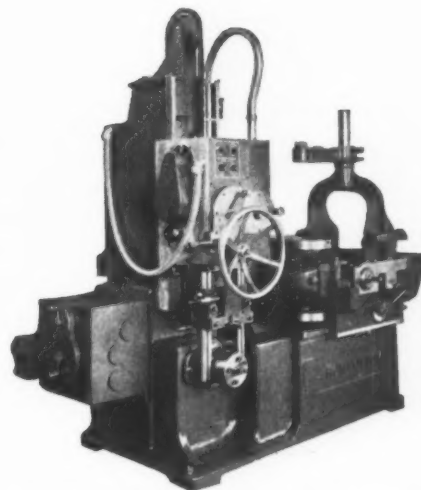
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Complete Cam Service Complete Satisfaction

Rowbottom's Contract Cam Service will take your cam problems out of your hands and supply the cams you need, whenever you need them, in any quantity. Or, if your use of cams warrants making them in your shop—your own Rowbottom Cam Milling Machine will produce every type of cam with modern production speed and economy. In either case, choose Rowbottom for cams and be sure of complete satisfaction.

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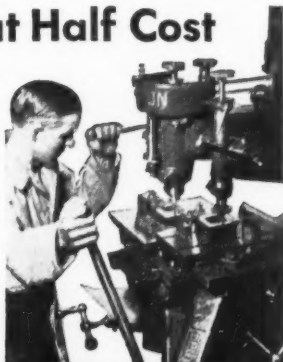
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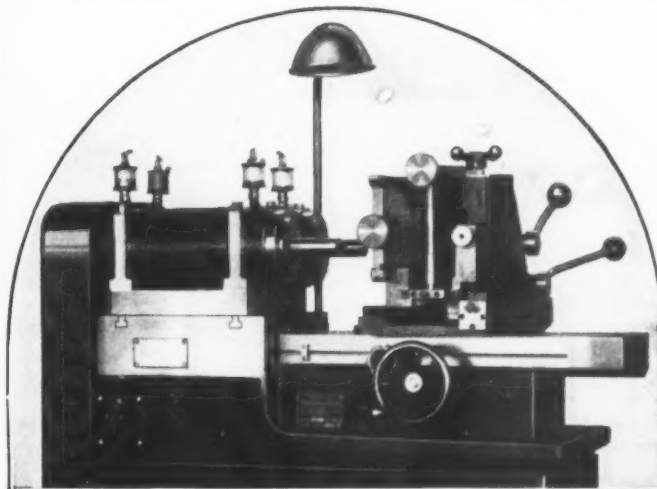
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Originators of the Automatic Drilling Head Unit



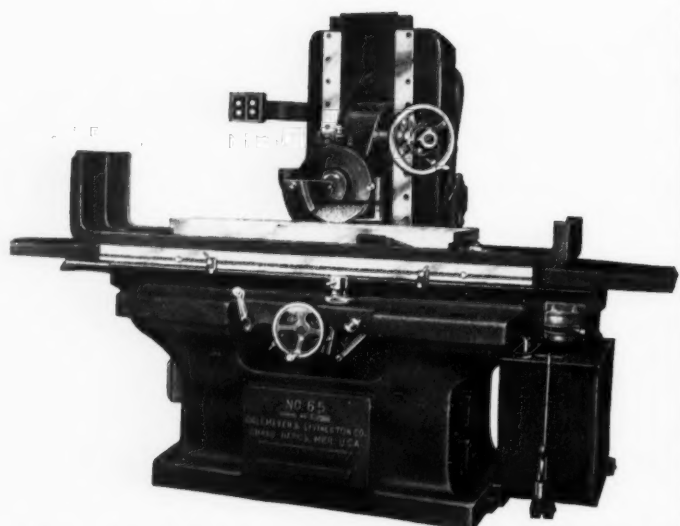
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and many other sizes are described in our new Bulletin GL 100.

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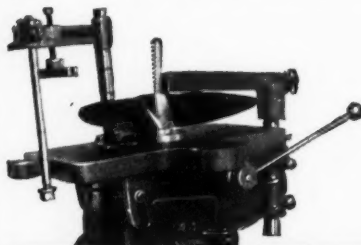
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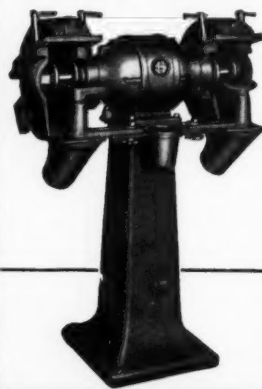
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Cuts keyways
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3" per foot.

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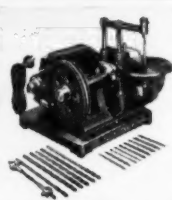
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Very Accurate

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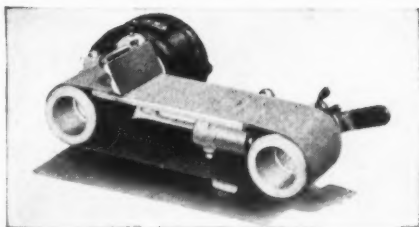
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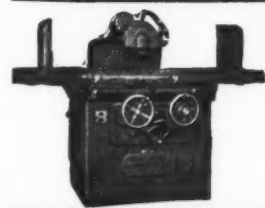
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Investigate! It's worth your while.

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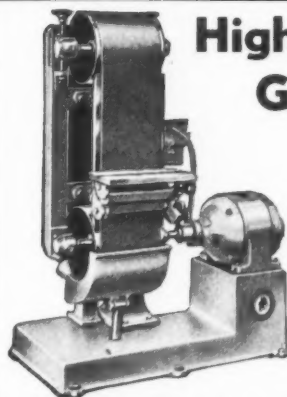


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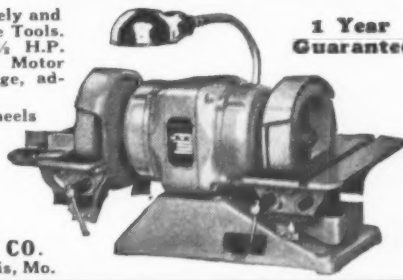
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—shown (from left to right) are . . .

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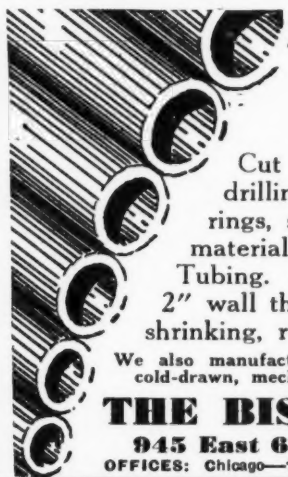
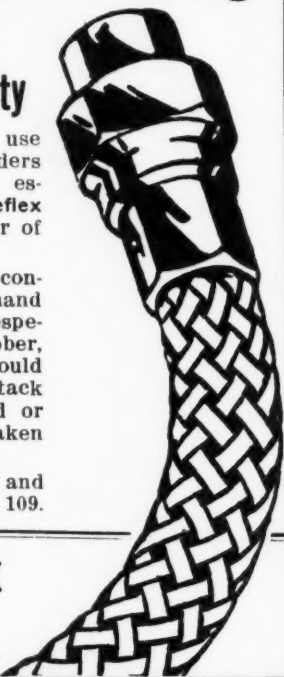
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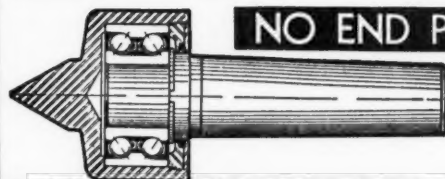
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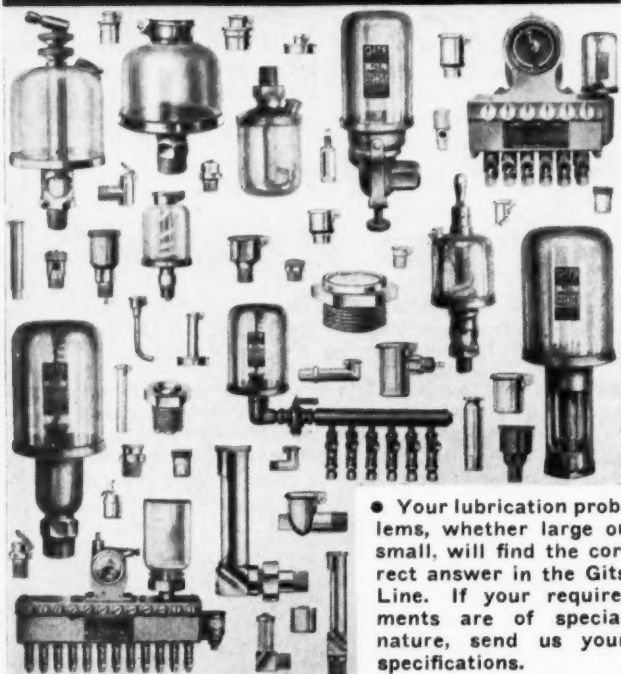


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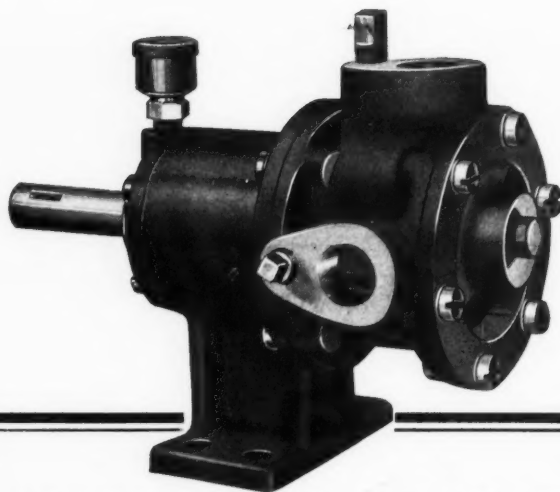
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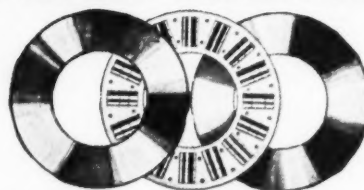
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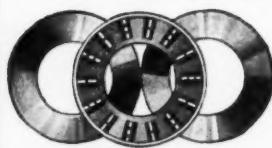
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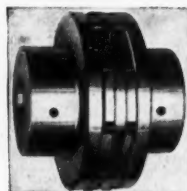
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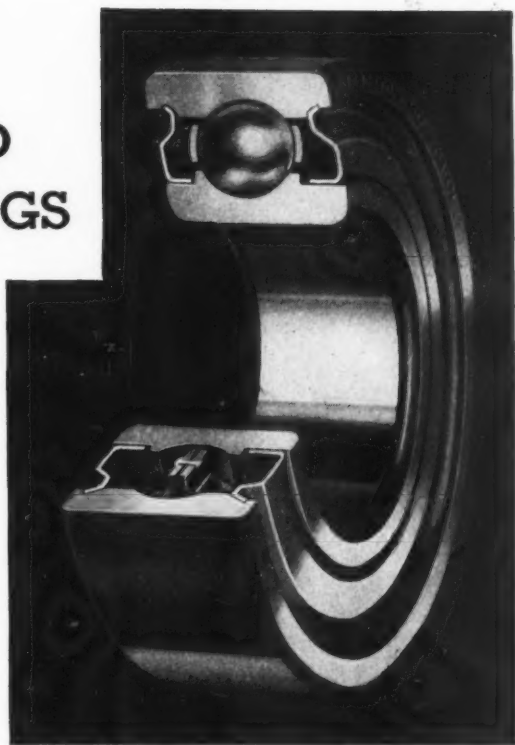
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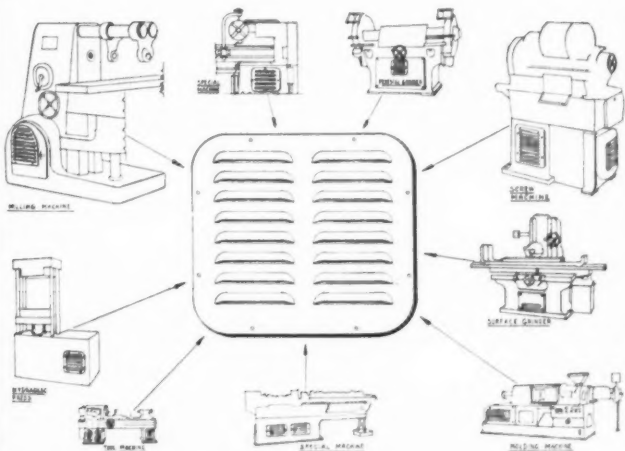
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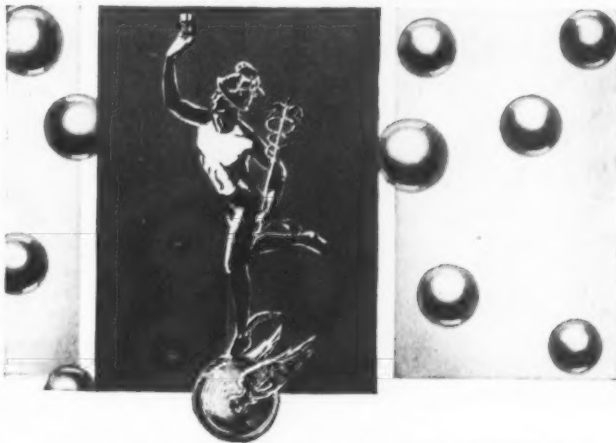
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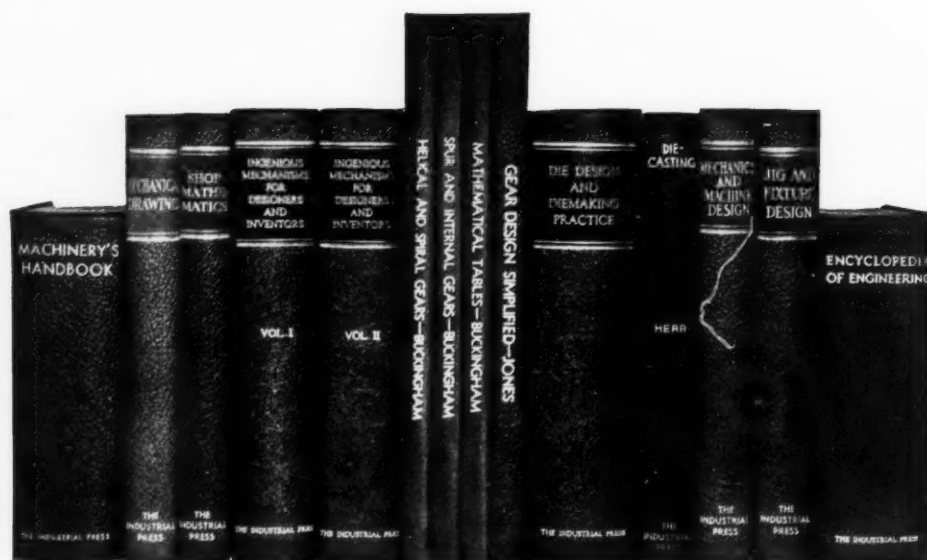
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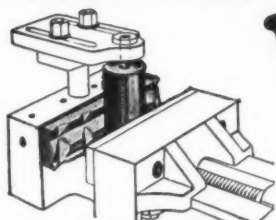


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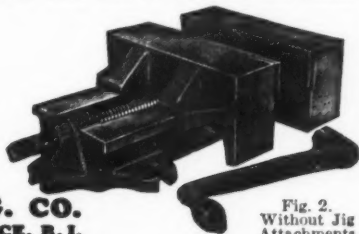


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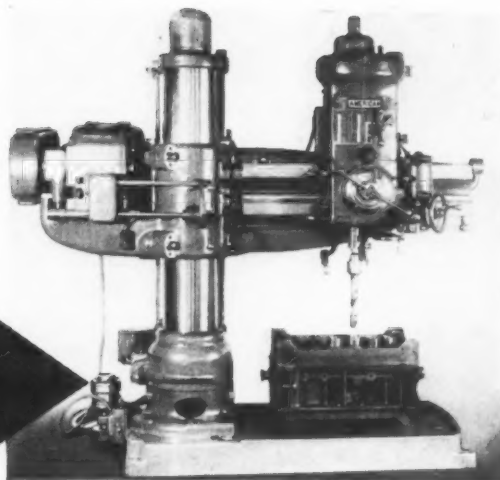
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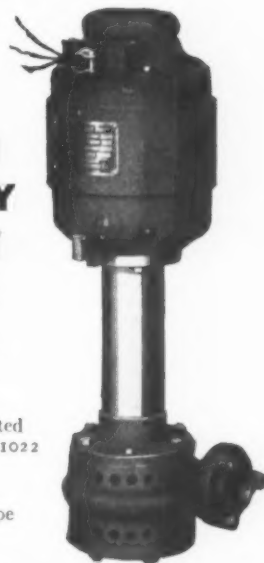
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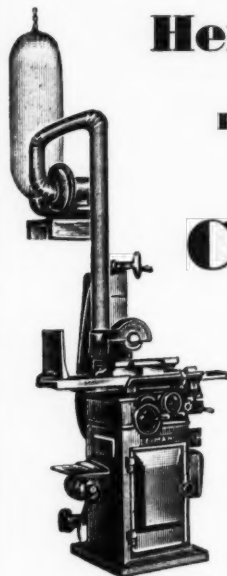
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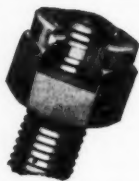
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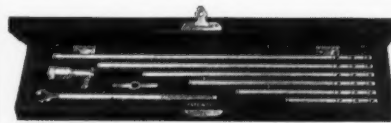
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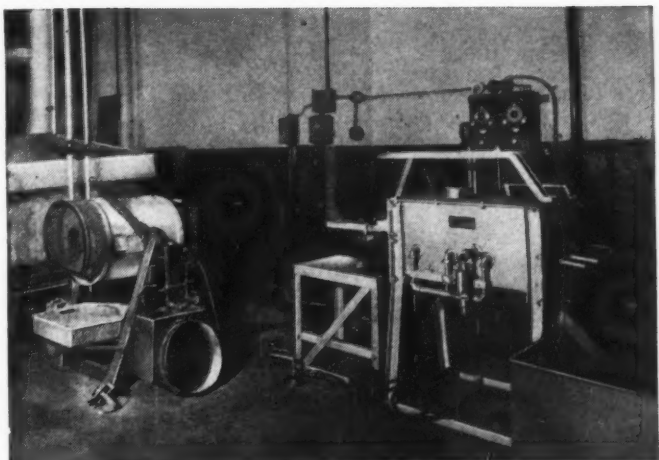
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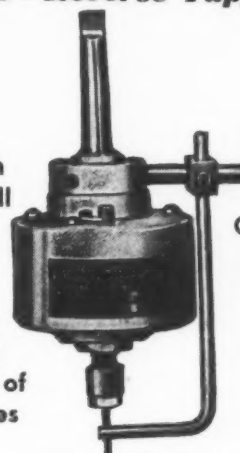
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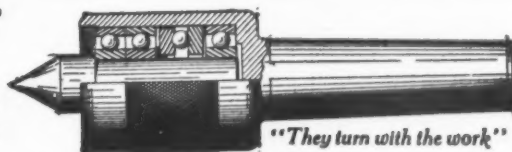
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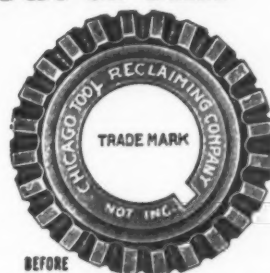
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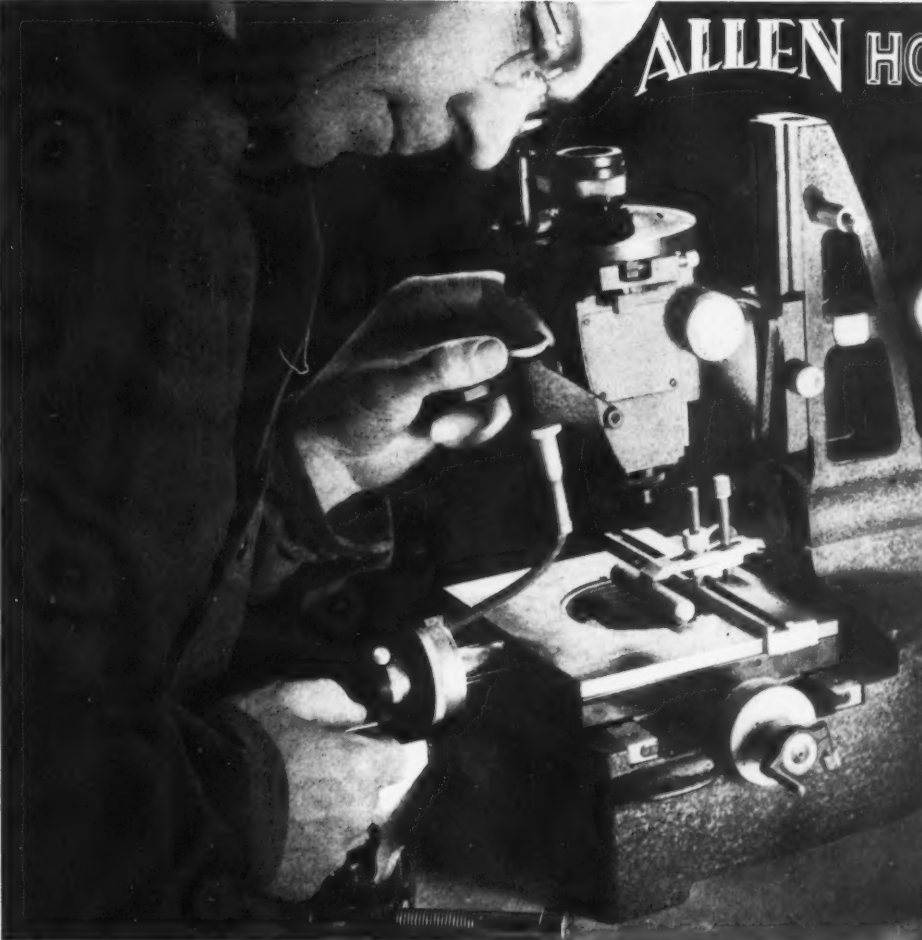
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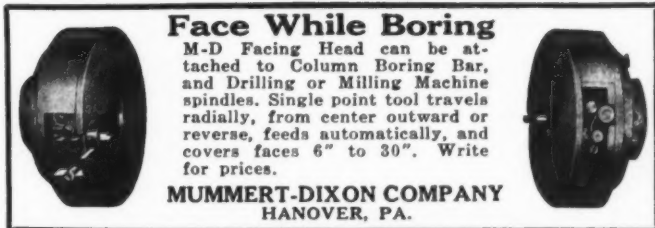
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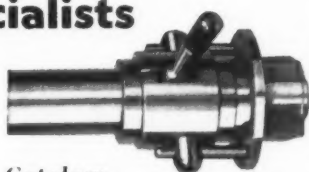
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28" Cincinnati Semi-Automatic Duplex, belt
48" Cincinnati Worm Driven Plain Auto., S.P.D.
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No. 4 Cincinnati Universal, three step cone
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9th Edition

MACHINERY'S Handbook

See Page 92

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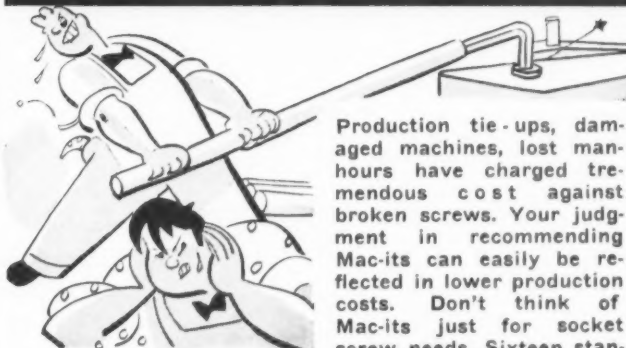
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For location of advertisements of manufacturers listed
in this index see alphabetical index, page 108

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Behr-Manning Corp., Div. Norton Co., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Walls Sales Corp., 96 Warren St., New York, N. Y.

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Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Morgan Engineering Co., Alliance, O.

AIR HOISTS

See Hoists, Air.

AIR TOOLS

See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

ALLOYS, STEEL, TUNGSTEN, VANADIUM, MANGANESE, ETC.

Carboloy Co., Inc., Detroit, Mich.
Carnegie-Illinois Steel Corp. (U.S. Steel Corp. Sub.), Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Haynes Steelite Co., Kokomo, Ind.
Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

ARBOR PRESSES

See Presses, Arbor.

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American Broach & Mch. Co., Ann Arbor, Mich.
Brown & Sharpe Mfg. Co., Providence, Cleveland Twist Drill Co., Cleveland, O.
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.
Gisholt Mch. Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Jacobs Mfg. Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

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Johnson Bronze Co., New Castle, Pa.
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Norton Co., Worcester, Mass.
Sundstrand Mch. Tool Co., Rockford, Ill.

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Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
S K F Industries, Inc., Philadelphia, Pa.
Waterbury Steel Ball Co., Inc., Poughkeepsie, N. Y.

BAR, BORING

See Boring Bars.

BAR, PHOSPHOR BRONZE

Johnson Bronze Co., New Castle, Pa.

BAR, STEEL

Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Inland Steel Co., 38 South Dearborn St., Chicago.
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Link-Belt Co., Chicago.

BEARINGS, BALL

Ball & Roller Bearing Co., Danbury, Conn.

Boston Gear Works, Inc., North Quincy, Mass.
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Federal Bearing Co., Inc., Poughkeepsie, N. Y.
Gwilliam Co., 360 Furman St., Brooklyn, N. Y.
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Norma-Hoffmann Bearings Corp., Stamford, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.

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New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

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Morgan Engineering Co., Alliance, O.

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See Hoists, etc.

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Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
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LeBlond, R. K., Mch. Tool Co., Cincinnati.
Lees-Bradford Co., Cleveland.
Modern Machine Corp., 323 Berry St., Brooklyn, N. Y.
Morgan Engineering Co., Alliance, O.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., Cleveland, O.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Pratt & Whitney Co., Hartford, Conn.
Ruthman Machinery Co., 534-536 E. Front St., Cincinnati, O.
Taylor-Shantz, Inc., Rochester, N. Y.
U. S. Tool Company, Inc., Ampere, N. J.
V & O Press Co., Hudson, N. Y.

CONTROLLERS

Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

CONVEYOR ROLLS, ROLLER BEARING

Shafer Bearing Corp., 35 East Wacker Drive, Room 2828, Chicago.

CORRESPONDENCE COURSES

Engineering Service Institute, Crystal Lake, Ill.

CONVEYORS, BELT

Link-Belt Co., Chicago.

COUNTERBORES

Carboly Co., Inc., Detroit, Mich.
Cleveland Twist Drill Co., Cleveland, O.
Ex-Cell-O Corporation, Detroit, Mich.
Gairing Tool Co., Detroit, Mich.
Haynes Stellite Co., Kokomo, Ind.
McCroskey Tool Corp., Meadville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S. Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

COUNTERSHAFTS

Brown & Sharpe Mfg. Co., Providence.
Diamond Machine Co., Providence, R. I.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Warner & Swasey Co., Cleveland.

COUNTERSINKS

Ex-Cell-O Corporation, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.

COUNTERS, REVOLUTION

Starrett, L. S. Co., Athol, Mass.
Veeder-Root, Inc., Hartford, Conn.

COUNTING DEVICES

Veeder-Root, Inc., Hartford, Conn.

COUPLERS, HOSE

Greene, Tweed & Co., 109 Duane St., New York City.

COUPLINGS, FLEXIBLE

Boston Gear Works, Inc., North Quincy, Mass.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Link-Belt Co., Chicago.
Lovejoy Flexible Coupling Co., 5021 W. Lake St., Chicago.
Philadelphia Gear Works, Philadelphia.
Whitney Chain & Mfg. Co., Hartford, Conn.

COUPLINGS, SHAFT

Boston Gear Works, Inc., North Quincy, Mass.
Link-Belt Co., Chicago.

CRANES, ELECTRIC TRAVELING

Harnischfeger Corp., Milwaukee, Wis.
Link-Belt Co., Chicago.
Morgan Engineering Co., Alliance, O.

CRANES, HAND TRAVELING

Harnischfeger Corp., Milwaukee, Wis.

CRANES, LOCOMOTIVE

Harnischfeger Corp., Milwaukee, Wis.
Link-Belt Co., Chicago.

CRANES, PORTABLE

Harnischfeger Corp., Milwaukee, Wis.

CRANK PIN TURNING MACHINES

American Tool Wks. Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati.

CUTTERS, GEAR

Brown & Sharpe Mfg. Co., Providence.
Ex-Cell-O Corporation, Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, MILLING

Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Carboly Co., Inc., Detroit, Mich.
Cleveland Twist Drill Co., Cleveland, O.
Columbus Die, Tool & Machine Co., Columbus, O.
Consolidated Machine Tool Corporation, Rochester, N. Y.
Ex-Cell-O Corporation, Detroit, Mich.
Gairing Tool Co., Detroit, Mich.
Gammons-Holman Co., Manchester, Conn.
Gorton, Geo., Machine Co., 1109 13th St., Racine, Wis.
Haynes Stellite Co., Kokomo, Ind.
Keeney & Trecker Corp., Milwaukee, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCroskey Tool Corp., Meadville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Newark Gear Cutting Mch. Co., Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Whitney Chain & Mfg. Co., Hartford, Conn.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, etc.

CUTTING-OFF MACHINES, ABRASIVE WHEEL

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.

CUTTING-OFF MACHINES, COLD SAW

See Sawing Machines, Circular.

CUTTING-OFF MACHINES

Brown & Sharpe Mfg. Co., Providence.
Landis Mch. Co., Inc., Waynesboro, Pa.
Scherr, Geo., Co., 128 Lafayette St., New York City.

CUTTING-OFF TOOLS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Haynes Stellite Co., Kokomo, Ind.
Pratt & Whitney Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Williams, J. H., & Co., 61 Spring St., New York, N. Y.

CYLINDER BORING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Consolidated Machine Tool Corporation, Rochester, N. Y.

CYLINDERS, HYDRAULIC

American Hollow Boring Co., Erie, Pa.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS' MACHINERY

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Cincinnati Machinery & Supply Co., Cincinnati.
Earle Gear & Mch. Co., 4709 Stenton Ave., Philadelphia.
Eastern Machinery Co., Cincinnati, O.
Miles Machinery Co., Saginaw, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago.

DEMAGNETIZERS

Heald Machine Co., Worcester, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

DESIGNERS, MACHINE AND TOOL

Hartford Special Machinery Co., Hartford, Conn.
Manufacturers' Consulting Engineers, Syracuse, N. Y.
Ruthman Machinery Co., 534-536 E. Front St., Cincinnati, O.

DIAMONDS AND DIAMOND TOOLS

Desmond-Stephan Mfg. Co., Urbana, O.

DIE CASTING MACHINES

Kux-Lohner Machine Co., 2145-47 Lexington St., Chicago.
Madison-Kipp Corp., Madison, Wis.

DIE CASTINGS

See Castings, Die or Pneumatic Mold.

DIE MAKERS' SUPPLIES

Baumbach, E. A. Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112 South 52nd Ave., Chicago.

U. S. Tool Company, Inc., Ampere, N. J.

DIE MAKING MACHINES

Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

DIE SETS, STANDARD

Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112 South 52nd Ave., Chicago.

DIE SINKING MACHINES

Cincinnati Milling Mch. Co., Cincinnati.
Gorton, Geo., Machine Co., 1109 13th St., Racine, Wis.
Pratt & Whitney Co., Hartford, Conn.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.

DIE STOCKS

See Stocks, Die.

DIES, SHEET METAL, ETC.

Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Columbus Die, Tool & Machine Co., Columbus, O.
Danly Machine Specialties, Inc., 2112 South 52nd Ave., Chicago.
Haynes Stellite Co., Kokomo, Ind.
Modern Machine Corp., 323 Berry St., Brooklyn, N. Y.
Niagara Mch. & Tool Works, Buffalo, N. Y.
Ruthman Machinery Co., 534-536 E. Front St., Cincinnati, O.
Taylor-Shantz, Inc., Rochester, N. Y.
V & O Press Co., Hudson, N. Y.
Waltham Mch. Wks., Waltham, Mass.

DIES, THREADING

Card, S. W., Mfg. Co., Mansfield, Mass.
Eastern Machine Screw Corp., New Haven, Conn.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.

H & G Works, Eastern Machine Screw Corp., New Haven Conn.**Jones & Lamson Machine Co., Springfield, Vt.****Landis Mch. Co., Inc., Waynesboro, Pa.****Murphy Mch. & Tool Co., 951 Porter St., Detroit, Mich.****National Acme Co., Cleveland, O.****Pratt & Whitney Co., Hartford, Conn.****DIES, THREADING, OPENING**

Consolidated Machine Tool Corporation, Rochester, N. Y.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 200 Broadway, New York.
Geometric Tool Co., New Haven, Conn.
H & G Works, Eastern Machine Screw Corp., New Haven, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murphy Mch. & Tool Co., 951 Porter St., Detroit, Mich.
National Acme Co., Cleveland, O.

DIES, THREAD ROLLING

Hanson-Whitney Machine Co., Hartford, Conn.

DISCS, ABRASIVE

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Carborundum Co., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Norton Co., Worcester, Mass.
Walls Sales Corp., 96 Warren St., New York, N. Y.

DOWEL PINS

Baumbach, E. A., Mfg. Co., 1810 S. Kilbourn Ave., Chicago.
Danly Machine Specialties, Inc., 2112 South 52nd Ave., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

DRAFTING MACHINES

Keuffel & Esser Co., Hoboken, N. J.

DRAWING BOARDS AND TABLES

Keuffel & Esser Co., Hoboken, N. J.

DRAWING INSTRUMENTS

Keuffel & Esser Co., Hoboken, N. J.

DRESSERS, GRINDING WHEEL

Carboly Co., Inc., Detroit, Mich.
Desmond-Stephan Mfg. Co., Urbana, O.
Norton Co., Worcester, Mass.

DRIFTS, DRILL

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.

DRILL HEADS, MULTIPLE

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Errington Mechanical Laboratory, 200 Broadway, N. Y.
Langelier Mfg. Co., Providence, R. I.
National Automatic Tool Co., Richmond, Ind.
Rockford Drilling Machine Co., Rockford, Ill.

DRILL SOCKETS

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Union Twist Drill Co., Athol, Mass.

DRILL SPEEDERS

Graham Mfg. Co., Providence, R. I.

DRILL STANDS

Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.
United States Electrical Tool Co., Cincinnati, Ohio.

DRILLING MACHINES, AUTOMATIC

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, W. F., & John, Co., Rockford.
Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
Kingsbury Machine Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence, R. I.
National Automatic Tool Co., Richmond, Ind.

DRILLING MACHINES, BENCH

Ames, B. C. Co., Waltham, Mass.
Barnes, W. F., & John, Co., Rockford.
Delta Mfg. Co., Milwaukee, Wis.
Dumore Co., Racine, Wis.
Elgin Tool Works, Inc., Elgin, Ill.
High Speed Hammer Co., Inc., Rochester, N. Y.
Kingsbury Machine Tool Corp., Keene, N. H.

Langelier Mfg. Co., Providence, R. I.**LeBlond, R. K., Mch. Tool Co., Cincinnati.****Leland-Gifford Co., Worcester, Mass.****National Automatic Tool Co., Richmond, Ind.****Rockford Drilling Machine Co., Rockford, Ill.****Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago.****United States Electrical Tool Co., Cincinnati, Ohio.****DRILLING MACHINES, BOILER**

Cincinnati Bickford Tool Co., Oakley, Cincinnati.

Foot-Burt Co., Cleveland, O.**DRILLING MACHINES, GANG**

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John, Co., Rockford.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.

Foot-Burt Co., Cleveland, O.**Kingsbury Machine Tool Corp., Keene, N. H.****Langelier Mfg. Co., Providence, R. I.****Leland-Gifford Co., Worcester, Mass.****Moline Tool Co., Moline, Ill.****Rockford Drilling Machine Co., Rockford, Ill.****Sundstrand Machine Tool Co., Rockford, Ill.****DRILLING MACHINES, HORIZONTAL DUPLEX**

Barnes, W. F., & John, Co., Rockford.

Langelier Mfg. Co., Providence, R. I.
Murphy Mch. & Tool Co., 951 Porter St., Detroit, Mich.

Rockford Drilling Machine Co., Rockford, Ill.
Sundstrand Machine Tool Co., Rockford, Ill.

DRILLING MACHINES, MULTIPLE SPINDLE

Barnes, Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John, Co., Rockford.
Cincinnati Bickford Tool Co., Oakley, Cincinnati.

Consolidated Machine Tool Corporation, Rochester, N. Y.

Foot-Burt Co., Cleveland, O.

Greenlee Bros. & Co., Rockford, Ill.

Kingsbury Machine Tool Corp., Keene, N. H.

Langelier Mfg. Co., Providence, R. I.

Leland-Gifford Co., Worcester, Mass.

Moline Tool Co., Moline, Ill.

National Automatic Tool Co., Richmond, Ind.

Pratt & Whitney Co., Hartford, Conn.

Rockford Drilling Machine Co., Rockford, Ill.

DRILLING MACHINES, RADIAL

American Tool Wks. Co., Cincinnati, O.

Carlton Machine Tool Co., Cincinnati.

Cincinnati Bickford Tool Co., Oakley, Cincinnati.

DRILLING MACHINES, RAIL

See heading Drilling Machines, Gang.

DRILLING MACHINES, SENSITIVE

Barnes, W. F., & John, Co., Rockford.

Foot-Burt Co., Cleveland, O.

High Speed Hammer Co., Inc., Rochester, N. Y.

Kingsbury Machine Tool Corp., Keene, N. H.

Langelier Mfg. Co., Providence, R. I.

Leiman Bros., Inc., Newark, N. J.

Leland-Gifford Co., Worcester, Mass.

Manufacturers' Consulting Engineers, Syracuse, N. Y.

Pratt & Whitney Co., Hartford, Conn.

Rockford Drilling Machine Co., Rockford, Ill.

Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago.

Sibley Machine & Fdry. Corp., South Bend, Ind.

DRILLING MACHINES, UPRIGHT

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Barnes, W. F., & John, Co., Rockford, Ill.

Cincinnati Bickford Tool Co., Oakley, Cincinnati.
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Machine Tool Corporation, Rochester, N. Y.
Delta Mfg. Co., Milwaukee, Wis.
Foote-Burt Co., Cleveland, O.
Kingsbury Machine Tool Corp., Keene, N. H.
Langelier Mfg. Co., Providence, R. I.
Leland-Gifford Co., Worcester, Mass.
Rockford Drilling Machine Co., Rockford, Ill.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago.
Sibley Machine & Fdry. Corp., South Bend, Ind.

DRILLING MACHINES, WALL RADIAL

Harnischfeger Corp., Milwaukee, Wis.
DRILLS, CENTER
Cleveland Twist Drill Co., Cleveland, O.
Gairing Tool Co., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

DRILLS, CORE

Carboloy Co., Inc., Detroit, Mich.
McCroskey Tool Corp., Medville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.

DRILLS, PORTABLE ELECTRIC

Dumore Co., Racine, Wis.
Errington Mechanical Laboratory, 200 Broadway, N. Y.
Haskins, R. G., Co., 4634 Fulton St., Chicago.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago.

DRILLS, RATCHET

Armstrong Brothers Tool Co., 313 N. Francisco Ave., Chicago.
Cleveland Twist Drill Co., Cleveland, O.
Greene, Tweed & Co., 109 Duane St., New York City.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

DRILLS, TWIST

Carboloy Co., Inc., Detroit, Mich.
Cleveland Twist Drill Co., Cleveland, O.
Colton, Arthur, Co., 2618 Jefferson Ave., E., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

DRILLS, WIRE

Union Twist Drill Co., Athol, Mass.

DRIVES, MOTORIZED BELT

Cullman Wheel Co., 1339 Altgeld St., Chicago.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady, N. Y.

ELEVATORS, MATERIAL HANDLING

Link-Belt Co., Chicago.

EMERY WHEELS

See Grinding Wheels.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel.

ENGINEERING, CONSULTING MECHANICAL

Manufacturers' Consulting Engineers, Syracuse, N. Y.

ENGRAVING MACHINES

Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Pratt & Whitney Co., Hartford, Conn.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.
United States Electrical Tool Co., Cincinnati, Ohio.

FACING MACHINE

Ex-Cell-O Corp., Detroit, Mich.

FANS, EXHAUST, ELECTRIC VENTILATING

General Electric Co., Schenectady, N. Y.

FEEDS FOR PUNCH PRESSES, AUTOMATIC

Littell, F. J., Mch. Co., 4125 Ravenswood Ave., Chicago.
S. & S. Machine Works, 4541 W. Lake St., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.
V & O Press Co., Hudson, N. Y.

FILES

Chicago Tool Reclaiming Co., 162 W. Hubbard St., Chicago.
Disston, Henry, & Sons, Inc., Philadelphia, Pa.

FILES, ROTARY

Strand, N. A. & Co., 5001 N. Wolcott Ave., Chicago.
United States Electrical Tool Co., Cincinnati, Ohio.

FILING MACHINES, DIE, ETC.

Ames, B. C. Co., Waltham, Mass.
Continental Machine Specialties, Inc., Minneapolis, Minn.
Haskins, R. G., Co., 4634 Fulton St., Chicago.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FITTINGS, HYDRAULIC

Hydraulic Press Mfg. Co., Mt. Gilead, O.

FLEXIBLE COUPLINGS

See Couplings, Flexible.

FLEXIBLE SHAFT EQUIPMENT

Dumore Co., Racine, Wis.
Errington Mechanical Laboratory, 200 Broadway, New York.
Haskins, R. G., Co., 4634 Fulton St., Chicago.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Strand, N. A. & Co., 5001 N. Wolcott Ave., Chicago.
United States Electrical Tool Co., Cincinnati, Ohio.

FORGES

American Gas Furnace Co., Elizabeth, N. J.

FORGING MACHINES

Acme Mfg. Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

FORGINGS, DROP

Williams, J. H., & Co., 61 Spring St., New York, N. Y.

FORGINGS, IRON AND STEEL

American Hollow Boring Co., Erie, Pa.
Morgan Engineering Co., Alliance, O.

FORGINGS, UPSET

Williams, J. H., & Co., 61 Spring St., New York, N. Y.

FORMING AND BENDING MACHINES

Niagara Machine & Tool Wks., Buffalo, N. Y.

FORMING AND STAMPING MACHINES

U. S. Tool Company, Inc., Ampere, N. J.

FOUNDRY EQUIPMENT

Link-Belt Co., Chicago.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.

FURNACES, HARDNESS

Leeds & Northrup Co., Philadelphia, Pa.

FURNACES, HEAT-TREATING ELECTRIC

General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Strong, Carlisle & Hammond Co., Cleveland.

FURNACES, HEAT-TREATING OIL, GAS, ETC.

American Gas Furnace Co., Elizabeth, N. J.
Strong, Carlisle & Hammond Co., Cleveland.

FURNITURE, DRAFTING ROOM

Keuffel & Esser Co., Hoboken, N. J.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.

FURNITURE, SHOP

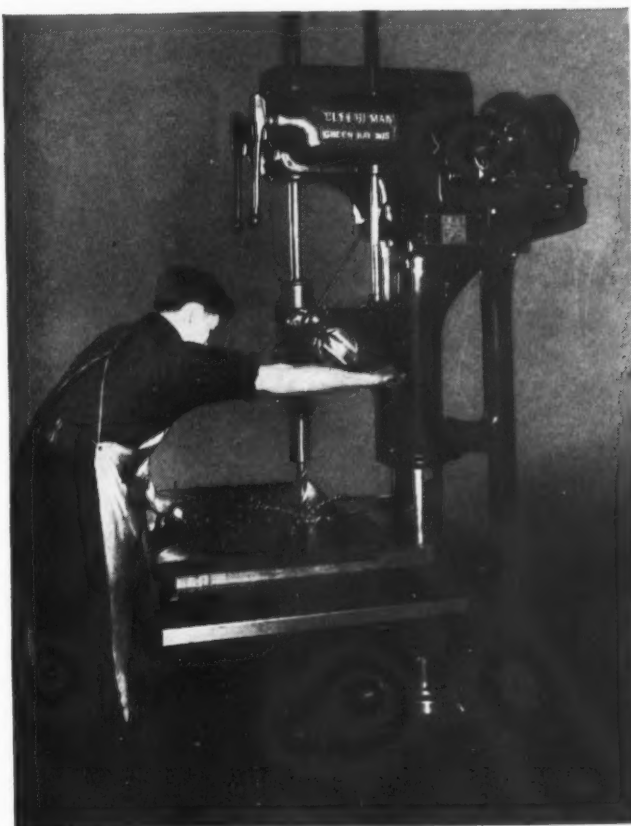
Angle Steel Stool Co., Plainwell, Mich.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.

GAGE BLOCKS

Ford Motor Co., (Johanson Div.), Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.

.. CLEEREMAN

DRILLING MACHINES



SLIDING
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ROUND OR
SQUARE
COLUMN

● At work in the plant of the Brust Tool Manufacturing Company, Chicago, well known makers of precision tools and fixtures, this round column 25" Cleereman Drill is giving highly satisfactory performance . . . It is fully geared . . . has anti-friction bearings . . . is automatically oiled . . . has single lever control of feeds and speeds . . . Furnished with reversing motor—no friction clutches . . . can be furnished with square column and in special arrangements . . . Tell us your drilling requirements—the Cleereman line of drilling machinery is complete . . . Write for descriptive bulletin.

CLEEREMAN MACHINE TOOL CO.
GREEN BAY, WIS.

GAGES, COMPARATOR

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Jones & Lamson Machine Co., Springfield, Vt.
Scherr, Geo., Co., 128 Lafayette St., New York City.
Zeiss, Carl, Inc., 485 Fifth Ave., New York, N. Y.

GAGES, DEPTH

Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence.
Starrett, L. S., Co., Athol, Mass.
Taylor-Shantz, Inc., Rochester, N. Y.

GAGES, DIAL

Ames, B. C., Co., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence.
Scherr, Geo., Co., 128 Lafayette St., New York City.
Starrett, L. S., Co., Athol, Mass.
Taylor-Shantz, Inc., Rochester, N. Y.

GAGES, HEIGHT

Brown & Sharpe Mfg. Co., Providence.
Starrett, L. S., Co., Athol, Mass.

GAGES, PLUG, RING AND SNAP

Brown & Sharpe Mfg. Co., Providence.
Cleveland Twist Drill Co., Cleveland, O.
Ex-Cell-O Corporation, Detroit, Mich.
Federal Products Corp., Providence.
Ford Motor Co. (Johansson Div.), Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.
Taylor-Shantz, Inc., Rochester, N. Y.

GAGES, SURFACE

Brown & Sharpe Mfg. Co., Providence.
Columbus Die, Tool & Machine Co., Columbus, O.
Starrett, L. S., Co., Athol, Mass.
Taylor-Shantz, Inc., Rochester, N. Y.

GAGES, TAPER

Brown & Sharpe Mfg. Co., Providence.
Ford Motor Co. (Johansson Div.), Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

GAGES, THREAD

Bath, John, & Co., Inc., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence.
Federal Products Corp., Providence.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

GASKETS

Garlock Packing Co., Palmyra, N. Y.
Greene, Tweed & Co., 109 Duane St., New York City.

GEAR BLANKS, NON-METALLIC

Ganschow, Wm., Co., Chicago.

GEAR CUTTING MACHINES, BEVEL (GENERATOR AND TEMPLET PLANNER)

Bilgram Gear & Machine Works, 1217-35 Spring Garden St., Philadelphia.
Gleason Works, Rochester, N. Y.

GEAR CUTTING MACHINES, BEVEL AND SPUR (ROTARY CUTTER)

Brown & Sharpe Mfg. Co., Providence.
Newark Gear Cutting Mch. Co., Newark, N. J.
Waltham Mch. Wks., Waltham, Mass.

GEAR CUTTING MACHINES, HELICAL AND SPUR (HOB)

Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence.
Lees-Bradner Co., Cleveland.
Newark Gear Cutting Mch. Co., Newark, N. J.

New Jersey Gear & Mfg. Co., Newark, N. J.
Scherr, Geo., Co., 128 Lafayette St., New York City.

GEAR CUTTING MACHINES, HELICAL AND SPUR (SHAPER OR PLANNER TYPE)

Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Fellows Gear Shaper Co., Springfield, Vt.

GEAR CUTTING MACHINES, SPIRAL BEVEL

Gleason Works, Rochester, N. Y.

GEAR CUTTING MACHINES, WORM AND WORM WHEELS (HOB)

Barber-Colman Co., Rockford, Ill.
Lees-Bradner Co., Cleveland.
Newark Gear Cutting Mch. Co., Newark, N. J.
New Jersey Gear & Mfg. Co., Newark, N. J.

GEAR HARDENING MACHINES

Gleason Works, Rochester, N. Y.

GEAR TESTING MACHINERY

Brown & Sharpe Mfg. Co., Providence.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland.
Manufacturers' Consulting Engineers, Syracuse, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Scherr, Geo., Co., 128 Lafayette St., New York City.

GEAR TOOTH GRINDING MACHINES

Lees-Bradner Co., Cleveland.

GEARS, CUT

Bilgram Gear & Machine Works, 1217-35 Spring Garden St., Philadelphia.
Boston Gear Works, Inc., North Quincy, Mass.
Brown & Sharpe Mfg. Co., Providence.
Crofoot, Chas. E., Gear Corp., So. Easton, Mass.
Cullman Wheel Co., 1339 Altgeld St., Chicago, Ill.
Diefendorf Gear Corp., Syracuse, N. Y.
Earle Gear & Mch. Co., 4709 Stenton Ave., Philadelphia.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Ganschow, Wm., Co., Chicago.
General Electric Co., Pittsfield, Mass.
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mch. Co., Hartford, Conn.
Lees-Bradner Co., Cleveland.
Link-Belt Co., Chicago.
Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass.
Newark Gear Cutting Mch. Co., Newark, N. J.
New Jersey Gear & Mfg. Co., Newark, N. J.
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia.
Pittsburgh Gear & Machine Co., 2700 Smallman St., Pittsburgh, Pa.
Scherr, Geo., Co., 128 Lafayette St., New York City.
Stahl Gear & Machine Co., Cleveland.

GEARS, MOLDED

Link-Belt Co., Chicago.
Philadelphia Gear Works, Philadelphia.
Stahl Gear & Machine Co., Cleveland.

GEARS, RAWHIDE AND NON-METALLIC

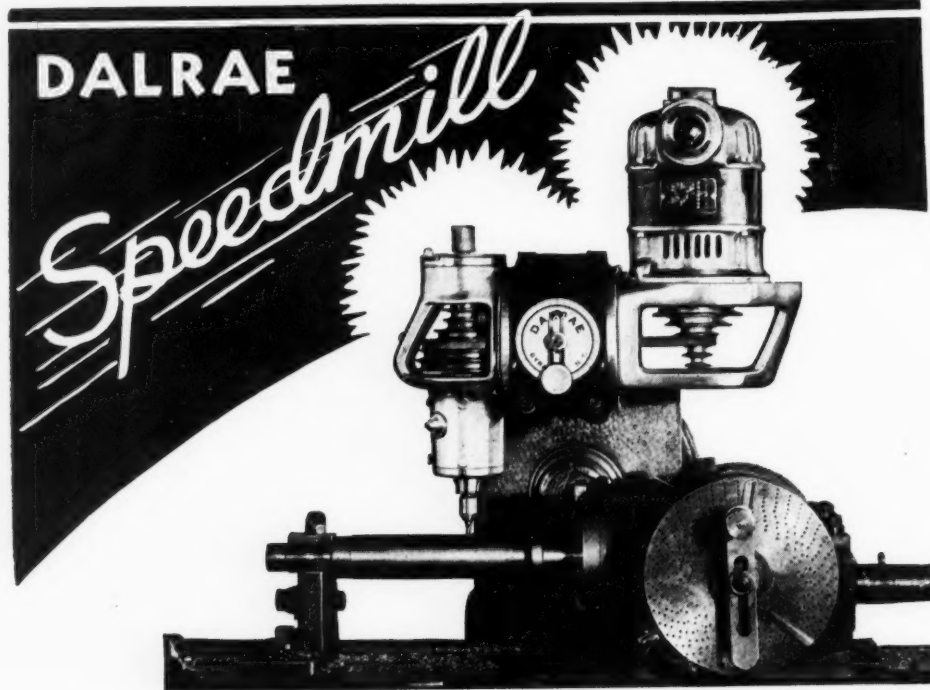
Boston Gear Works, Inc., North Quincy, Mass.
Diefendorf Gear Corp., Syracuse, N. Y.
Earle Gear & Mch. Co., 4709 Stenton Ave., Philadelphia.
Ganschow, Wm., Co., Chicago.
General Electric Co., Pittsfield, Mass.
Grant Gear Works, Inc., Boston, Mass.
Hartford Special Mch. Co., Hartford, Conn.
Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass.
Newark Gear Cutting Mch. Co., Newark, N. J.
Philadelphia Gear Works, Philadelphia.
Pittsburgh Gear & Machine Co., 2700 Smallman St., Pittsburgh, Pa.
Stahl Gear & Machine Co., Cleveland.

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Production Mch. Co., Greenfield, Mass.
Walls Sales Corp., 96 Warren St., New York, N. Y.

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New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago.
United States Electrical Tool Co., Cincinnati, Ohio.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, CAMSHAFT

Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

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Ex-Cell-O Corporation, Detroit, Mich.
Oliver Instrument Co., Adrian, Mich.
Stokemnit Corp., Milwaukee, Wis.

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Cincinnati Grinders Inc., Cincinnati.

GRINDING MACHINES, CHASER OR DIE

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Geometric Tool Co., New Haven, Conn.
H & G Works, Eastern Machine Screw Corp., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.

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Bryant Chucking Grinder Co., Springfield, Vt.

GRINDING MACHINES, CRANKSHAFT

Cincinnati Grinders Inc., Cincinnati.
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDING MACHINES, CUTTER

See Grinding Machines, Tool & Cutter.

GRINDING MACHINES, CYLINDER

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Landis Tool Co., Waynesboro, Pa.

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Cincinnati Grinders Inc., Cincinnati.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Works (Consolidated Mch. Tool Corp.), Rochester, N. Y.
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Norton Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
United States Electrical Tool Co., Cincinnati, Ohio.

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Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Diamond Machine Co., Providence, R. I.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hanchett Mfg. Co., Big Rapids, Mich.
Rowbottom Machine Co., Waterbury, Conn.
United States Electrical Tool Co., Cincinnati, Ohio.

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Morse Twist Drill & Machine Co., New Bedford, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Union Twist Drill Co., Athol, Mass.

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Diamond Machine Co., Providence, R. I.
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United States Electrical Tool Co., Cincinnati, Ohio.

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Scherr, Geo., Co., 128 Lafayette St., New York City.
Union Twist Drill Co., Athol, Mass.

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Greenfield Tap & Die Corp., Greenfield, Mass.

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Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Van Norman Mch. Tool Co., Springfield, Mass.

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Graham Mfg. Co., Providence, R. I.
Hanchett Mfg. Co., Big Rapids, Mich.

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Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

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Blanchard Machine Co., 64 State St., Cambridge, Mass.

Brown & Sharpe Mfg. Co., Providence.
Diamond Machine Co., Providence, R. I.
Gallmeyer & Livingston Co., Grand Rapids, Mich.

Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.

Hanchett Mfg. Co., Big Rapids, Mich.

Heald Machine Co., Worcester, Mass.

Mattison Machine Works, Rockford, Ill.

Norton Co., Worcester, Mass.

Pratt & Whitney Co., Hartford, Conn.

Rowbottom Machine Co., Waterbury, Conn.

United States Electrical Tool Co., Cincinnati, Ohio.

Walker, O. S., Co., Inc., Worcester, Mass.

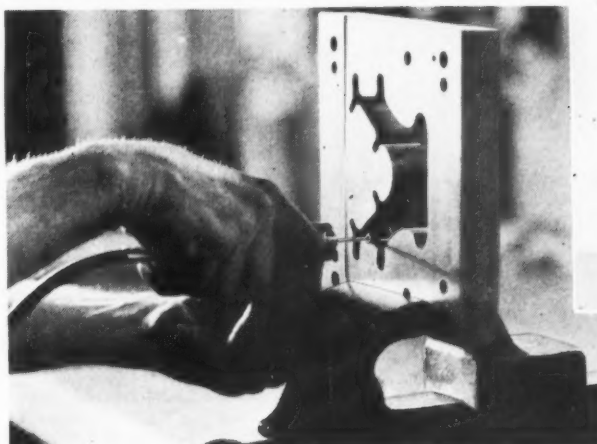
GRINDING MACHINES, SWING FRAME

Diamond Machine Co., Providence, R. I.

GRINDING MACHINES, TAP

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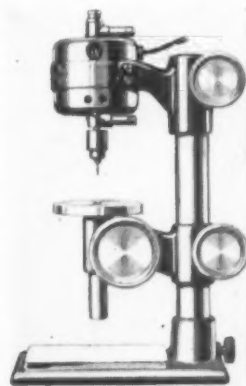
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Gallmeyer & Livingston Co., Grand Rapids, Mich.
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Morse Twist Drill & Machine Co., New Bedford, Mass.

Mummert-Dixon Co., Hanover, Pa.
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New Jersey Gear & Mfg. Co., Newark, N. J.
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United States Electrical Tool Co., Cincinnati, Ohio.
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Walker, O. S., Co., Inc., Worcester, Mass.
Waltham Mch. Wks., Waltham, Mass.

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Nazel Engineering & Mch. Wks., 4043 N. 5th St., Philadelphia, Pa.

HAMMERS, HELVE RIVETING

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Nazel Engineering & Mch. Wks., 4043 N. 5th St., Philadelphia, Pa.

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HAMMERS, STEAM

Morgan Engineering Co., Alliance, O.

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Link-Belt Co., Chicago.

Shafer Bearing Corp., 35 East Wacker Drive, Room 2828, Chicago.

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Standard Pressed Steel Co., Jenkintown, Pa.

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Surface Combustion Co., Toledo, O.

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National Twist Drill & Tool Co., Detroit, Mich.

Newark Gear Cutting Mch. Co., Newark, N. J.

New Jersey Gear & Mfg. Co., Newark, N. J.

Union Twist Drill Co., Athol, Mass.

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Link-Belt Co., Chicago.

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HOISTS, ELECTRIC

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Philadelphia Gear Works, Philadelphia.

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Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

Moline Tool Co., Moline, Ill.

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Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago.

Morgan Engineering Co., Alliance, O.

Oilgear Co., Milwaukee, Wis.

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Ex-Cell-O Corporation, Detroit, Mich.

National Automatic Tool Co., Richmond, Ind.

HYDRAULIC MACHINERY AND TOOLS

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Hydraulic Press Mfg. Co., Mt. Gilead, O.

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Brown & Sharpe Mfg. Co., Providence.

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Starrett, L. S., Co., Athol, Mass.

INDICATORS, SPEED

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Scherr, Geo., Co., 128 Lafayette St., New York City.

Starrett, L. S., Co., Athol, Mass.

Veeder-Root, Inc., Hartford, Conn.

INDICATORS, TEST

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Federal Products Corp., Providence.

Norton Co., Worcester, Mass.

Starrett, L. S., Co., Athol, Mass.

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Elmes, Chas. F., Engineering Works, 222 N. Morgan St., Chicago.

Hydraulic Press Mfg. Co., Mt. Gilead, O.

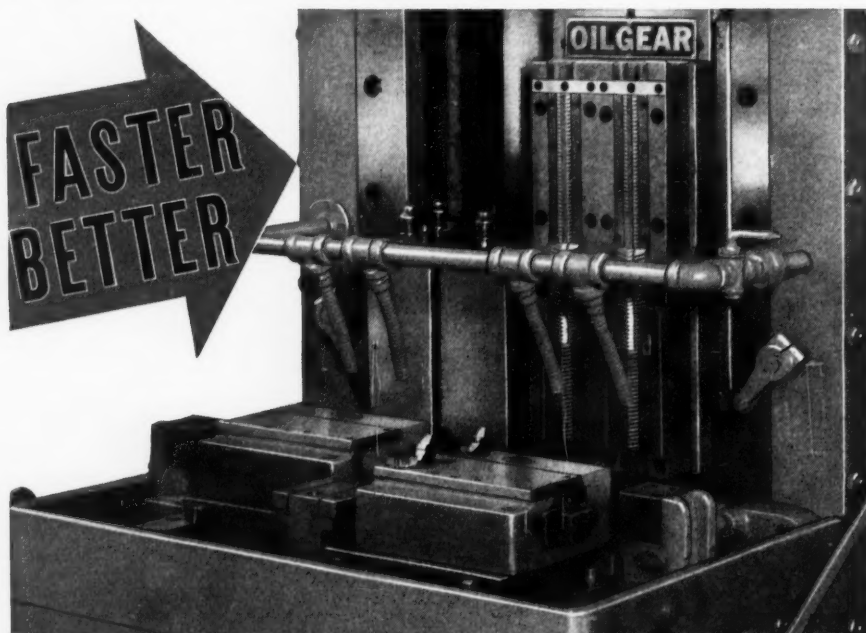
Morgan Engineering Co., Alliance, O.

JACKS, PLANER

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Sundstrand Machine Tool Co., Rockford, Ill.
Taylor-Shantz, Inc., Rochester, N. Y.

KEYSEATERS

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KNURL HOLDERS

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Pratt & Whitney Co., Hartford, Conn.

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Pratt & Whitney Co., Hartford, Conn.
Williams, J. H. & Co., 61 Spring St., New York, N. Y.

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Norton Co., Worcester, Mass.

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Gisholt Mch. Co., Madison, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
McCrosky Tool Corp., Meadville, Pa.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Sundstrand Machine Tool Co., Rockford, Ill.
United States Electrical Tool Co., Cincinnati, O.

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Jones & Lamson Machine Co., Springfield, Vt.
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Lodge & Shipley Machine Tool Co., Cincinnati, O.
National Acme Co., Cleveland, O.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.
Sundstrand Machine Tool Co., Rockford, Ill.

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Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Machine Tool Co., Rockford, Ill.

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Elgin Tool Works, Inc., Elgin, Ill.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
South Bend Lathe Works, Inc., South Bend, Ind.

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Seneca Falls Mch. Co., Seneca Falls, N. Y.
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Lodge & Shipley Machine Tool Co., Cincinnati, O.
Sundstrand Machine Tool Co., Rockford, Ill.

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Boye & Emmes Mch. Tool Co., Cincinnati.

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Consolidated Machine Tool Corporation, Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
Pratt & Whitney Co., Hartford, Conn.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago.

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Consolidated Machine Tool Corporation, Rochester, N. Y.
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LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
South Bend Lathe Works, Inc., South Bend, Ind.

LATHES, GUN BORING

Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.

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See Chucking Machines.

LATHES, TOOLROOM

See Lathes, Engine and Toolroom.

LATHES, TURRET

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Cincinnati Lathe & Tool Co., Oakley, Cincinnati, O.
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Jones & Lamson Machine Co., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Lodge & Shipley Machine Tool Co., Cincinnati, O.
National Acme Co., Cleveland, O.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Pratt & Whitney Co., Hartford, Conn.

Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
South Bend Lathe Works, Inc., South Bend, Ind.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
Warner & Swasey Co., Cleveland.

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Universal Boring Machine Co., Hudson, Mass.

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Zeiss, Carl, Inc., 485 Fifth Ave., New York, N. Y.

METALS, BEARING

See Bearing Bronze, Babbitt, etc., and Bushings, Brass, Bronze, etc.

METALLOGRAPHIC EQUIPMENT

Scherr, Geo., Co., 128 Lafayette St., New York City.

METERS (See Recording Instruments).**MICROMETERS**

Bath, John, & Co., Inc., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence.
International Tool Co., Oakland, Cal.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

MICROSCOPES, TOOLMAKERS'

Scherr, Geo., Co., 128 Lafayette St., New York City.
Zeiss, Carl, Inc., 485 Fifth Ave., New York, N. Y.

MILLING ATTACHMENT

Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Dalrae Tools Co., Syracuse, N. Y.
Elgin Tool Works, Inc., Elgin, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, AUTOMATIC

Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Potter & Johnston Mch. Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
U. S. Tool Company, Inc., Ampere, N. J.

MILLING MACHINES, BENCH

Ames, B. C., Co., Waltham, Mass.
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.

MILLING MACHINES, CIRCULAR CONTINUOUS

Consolidated Machine Tool Corporation, Rochester, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Machine Tool Co., Rockford, Ill.

MILLING MACHINES, DUPLEX

Kearney & Trecker Corp., Milwaukee, Wis.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, HAND

Pratt & Whitney Co., Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, HORIZONTAL PLAIN AND UNIVERSAL

Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
LeBlond, R. K., Mch. Tool Co., Cincinnati, O.
Rowbottom Machine Co., Waterbury, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, LINCOLN TYPE

Brown & Sharpe Mfg. Co., Providence.
Pratt & Whitney Co., Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING MACHINES, PLANNER TYPE

Kearney & Trecker Corp., Milwaukee, Wis.

MILLING MACHINES, UNIVERSAL

Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.
Sundstrand Machine Tool Co., Rockford, Ill.

MILLING MACHINES, VERTICAL

Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Sundstrand Machine Tool Co., Rockford, Ill.
Van Norman Mch. Tool Co., Springfield, Mass.

MILLING AND DRILLING MACHINES, UPRIGHT

See Drilling and Milling Machines, Vertical.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES

Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Preis, H. P., Engraving Mch. Co., 157 Summit St., Newark, N. J.

MOLDED PLASTIC PRODUCTS

Bakelite Corp., 247 Park Ave., New York, N. Y.

MOLYBDENUM

Climax Molybdenum, 500 Fifth Ave., New York, N. Y.

MOTORS, ELECTRIC

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldor Electric Co., St. Louis, Mo.
Dunmore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
Lincoln Electric Co., Cleveland.

NAME PLATES

Pittsburgh Stamp Co., Inc., Pittsburgh, Pa.

NIBBLING MACHINES

Gray Machine Co., Philadelphia, Pa.
Schatz Mfg. Co., Poughkeepsie, N. Y.

NICKEL

International Nickel Co., 67 Wall St., New York.

NIPPLE THREADING MACHINERY

Landis Mch. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Murphy Mch. & Tool Co., 951 Porter St., Detroit.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

OIL CUPS

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Boston Gear Works, Inc., North Quincy, Mass.

OIL GROOVERS

Hanson-Whitney Mch. Co., Hartford, Conn.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.

OIL HOLE COVERS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.

OILERS

Madison-Kipp Corp., Madison, Wis.

OILS, CUTTING

Texas Co., 135 East 42nd St., New York, N. Y.

OILS, LUBRICATING

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Pyroil Co., LaCrosse, Wis.
Shell's Industrial Lubricants Div., 50 W. 50th St., New York, N. Y.
Sun Oil Co., Philadelphia.
Texas Co., 135 East 42nd St., New York, N. Y.

OILS, QUENCHING AND TEMPERING

Sun Oil Co., Philadelphia.

OILS, SOLUBLE

See Compounds, Cutting, Grinding, etc.

OXYGEN

Air Products Co., The, 30 E. 42nd St., New York.

PACKING, LEATHER, METAL, RUBBER, ETC.

Garlock Packing Co., Palmyra, N. Y.

PARALLELS

Brown & Sharpe Mfg. Co., Providence.
Ford Motor Co., Johanson Div., Detroit, Mich.
Starrett, L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, METAL

V & O Press Co., Hudson, N. Y.

PATTERNS, WOOD

Mummert-Dixon Co., Hanover, Pa.
V & O Press Co., Hudson, N. Y.

PHOSPHOR BRONZE

See Bronze.

PILLOW BLOCKS

Link-Belt Co., Chicago.
Shafer Bearing Corp., 35 East Wacker Drive, Room 2828, Chicago.

PIPE CUTTING AND THREADING MACHINES

Foot-Burt Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Murphy Mch. & Tool Co., 951 Porter St., Detroit, Mich.

PIPE, STEEL

National Tube Co. (U. S. Steel Corp. Sub.), Pittsburgh, Pa.

PIPE TONGS

Williams, J. H., & Co., 61 Spring St., New York, N. Y.

PLANNER ATTACHMENTS

Cincinnati Planer Co., Cincinnati, O.
Hanson-Whitney Mch. Co., Hartford, Conn.

PLANERS

American Tool Wks. Co., Cincinnati, O.
Cincinnati Planer Co., Cincinnati, O.
Consolidated Machine Tool Corporation, Rochester, N. Y.
Rockford Machine Tool Co., Rockford, Ill.

PLATE ROLLS

Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago.
Schatz Mfg. Co., Poughkeepsie, N. Y.

PLATES, SURFACE

Brown & Sharpe Mfg. Co., Providence.
U. S. Tool Company, Inc., Ampere, N. J.

PNEUMATIC EQUIPMENT

Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.

POLISHING LATHES AND MACHINES

Besly, Chas. H., & Co., 120-B N. Clinton St., Chicago.
Continental Machine Specialties, Inc., Minneapolis, Minn.
Diamond Machine Co., Providence, R. I.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
New Britain-Gridley Mch. Div. New Britain, Conn.
Production Mch. Co., Greenfield, Mass.
United States Electrical Tool Co., Cincinnati, O.

PRESSES, ARBOR

American Broach & Mch. Co., Ann Arbor, Mich.
Barnes, W. F., & John, Co., Rockford, Ill.
Elmes, Chas. F., Engineering Works, 222 N. Morgan St., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Lucas Mch. Tool Co., Cleveland, O.
Tomkins-Johnson Co., Jackson, Mich.

PRESSES, BROACHING

American Broach & Mch. Co., Ann Arbor, Mich.
Lucas Mch. Tool Co., Cleveland, O.
Oilgear Co., Milwaukee, Wis.
V & O Press Co., Hudson, N. Y.

PRESSES, DROP

See Hammers, Drop.

PRESSES, FOOT

Baird Machine Co., Bridgeport, Conn.
Niagara Machine & Tool Wks., Buffalo, N. Y., and Ansonia, Conn.
V & O Press Co., Hudson, N. Y.

PRESSES, FORGING

Morgan Engineering Co., Alliance, O.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, HYDRAULIC

American Broach & Mch. Co., Ann Arbor, Mich.
Elmes, Chas. F., Engineering Works, 222 N. Morgan St., Chicago.
Farrel-Birmingham Co., Inc., Buffalo, N. Y., and Ansonia, Conn.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Morgan Engineering Co., Alliance, O.
Oilgear Co., Milwaukee, Wis.

PRESSES, PERCUSSION

Zeh & Hahnemann Co., Newark, N. J.

PRESSES, SCREW

Barnes, W. F., & John, Co., Rockford, Ill.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

PRESSES, SHEET METAL WORKING

Baird Machine Co., Bridgeport, Conn.
Cincinnati Shaper Co., Cincinnati, O.
Clearing Machine Corp., 6499 West 65th St., Chicago.

Losbough-Jordan Tool & Mch. Co., Elkhart, Ind.

Niagara Machine & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Taylor-Shantz, Inc., Rochester, N. Y.
V & O Press Co., Hudson, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, STRAIGHTENING

Elmes, Chas. F., Engineering Works, 222 N. Morgan St., Chicago.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Morgan Engineering Co., Alliance, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mch. Tool Co., 631 South-ern Ave., Springfield, O.

PROFILING MACHINES

Gorton, Geo., Mch. Co., 1109 13th St., Racine, Wis.
Leland-Gifford Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Preis Engraving Machine Co., 157 Summit St., Newark, N. J.

PULLEYS

Boston Gear Works, Inc., North Quincy, Mass.
Link-Belt Co., Chicago.

PULLEYS, FRICTION

Link-Belt Co., Chicago.

PULLEYS, V-BELT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.

PUMPS, COOLANT, LUBRICANT AND OIL

Brown & Sharpe Mfg. Co., Providence.
Ruthman Machinery Co., 534-536 E. Front St., Cincinnati, O.
Tomkins-Johnson Co., Jackson, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, HYDRAULIC

Elmes, Chas. F., Engineering Works, 222 N. Morgan St., Chicago.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Oilgear Co., Milwaukee, Wis.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, ROTARY

Leiman Bros., Inc., Newark, N. J.
National Acme Co., Cleveland, O.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, VACUUM

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Leiman Bros., Inc., Newark, N. J.

PUNCHING MACHINERY

Armstrong-Blum Mfg. Co., 5743 Bloom-ington Ave., Chicago.
Cincinnati Shaper Co., Cincinnati, O.
Consolidated Machine Tool Corporation, Rochester, N. Y.
Losbough-Jordan Tool & Mch. Co., Elkhart, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 West 16th St., Chicago.
Wiedemann Machine Co., Philadelphia.

PYROMETERS

American Gas Furnace Co., Elizabeth, N. J.
Leeds & Northrup Co., Philadelphia.
Shore Instrument & Mfg. Co., Jamaica, N. Y.

RACKS, GEAR, CUT

Boston Gear Works, Inc., North Quincy, Mass.
Fellows Gear Shaper Co., Springfield, Vt.
Hartford Special Mch. Co., Hartford, Conn.

Massachusetts Gear & Tool Co., 34 Nashua St., Woburn, Mass.
Newark Gear Cutting Mch. Co., Newark, N. J.

Philadelphia Gear Works, Philadelphia.
Stahl Gear & Machine Co., Cleveland.

RACKS, STOCK, TOOL AND PATTERN

Angle Steel Stool Co., Plainwell, Mich.

RADIATORS, JAPANNING-OVEN

American Gas Furnace Co., Elizabeth, N. J.

REAMER HOLDERS

Gisholt Machine Co., Madison, Wis.
Landis Mch. Co., Inc., Waynesboro, Pa.
McCroskey Tool Corp., Meadville, Pa.

REAMERS

Barber-Colman Co., Rockford, Ill.
Carboly Co., Inc., Detroit, Mich.
Card, S. W., Mfg. Co., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland, O.
Columbus Die, Tool & Machine Co., Columbus, O.
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.
Ex-Cell-O Corporation, Detroit, Mich.
Gammons-Holman Co., Manchester, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Kokomo, Ind.
McCroskey Tool Corp., Meadville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.

National Twist Drill & Tool Co., Detroit, Mich.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.
Wetmore Reamer Co., 412 No. 27th St., Milwaukee, Wis.

REAMERS, ADJUSTABLE

Barber-Colman Co., Rockford, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Davis Boring Tool Co., Inc., 6200 Maple Ave., St. Louis, Mo.
Gisholt Mch. Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
McCroskey Tool Corp., Meadville, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.
Wetmore Reamer Co., 412 No. 27th St., Milwaukee, Wis.

REAMERS, TAPER PIN HOLE

Gammans-Holman Co., Manchester, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

REAMING MACHINES

Blanchard Machine Co., 64 State St., Cambridge, Mass.

RECORDING INSTRUMENTS FOR ELECTRICITY

General Electric Co., Schenectady, N. Y.
Leeds & Northrup Co., Philadelphia

RECORDING INSTRUMENTS FOR PRESSURE

Leeds & Northrup Co., Philadelphia

RECORDING INSTRUMENTS FOR SPEED

Leeds & Northrup Co., Philadelphia

RECORDING INSTRUMENTS FOR TEMPERATURES

Leeds & Northrup Co., Philadelphia

REELS, STOCK, STANDARD AND AUTOMATIC

S. & S. Machine Works, 4541 W. Lake St., Chicago.
U. S. Tool Company, Inc., Ampere, N. J.

REGULATORS, TEMPERATURE

American Gas Furnace Co., Elizabeth, N. J.
Leeds & Northrup Co., Philadelphia

REMOVERS, JAPAN, ENAMEL, ETC.

Oakite Products, Inc., 26 Thames St., New York City

RENTING AGENTS

Ross, Browne & Fleming, 919 No. Michigan Ave., Chicago

RHEOSTATS

General Electric Co., Schenectady, N. Y.

RIVETERS, HYDRAULIC

Morgan Engineering Co., Alliance, O.

RIVETERS, PNEUMATIC

Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
Hannifin Mfg. Co., 621 S. Kolmar Ave., Chicago.
Tomkins-Johnson Co., Jackson, Mich.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago

RIVETING MACHINES

Grant Mfg. & Mch. Co., N. W. Station, Bridgeport, Conn.
High Speed Hammer Co., Inc., Rochester, N. Y.
Tomkins-Johnson Co., Jackson, Mich.

RULES, STEEL

Brown & Sharpe Mfg. Co., Providence.
Keuffel & Esser Co., Hoboken, N. J.
Starrett, L. S. Co., Athol, Mass.

RUST PREVENTIVE

Oakite Products, Inc., 26 Thames St., New York City

SAFETY GUARDS FOR PUNCH PRESSES

Taylor-Shantz, Inc., Rochester, N. Y.
Wiesman Mfg. Co., Dayton, O.

SAND BLAST EQUIPMENT

Leiman Bros., Inc., Newark, N. J.
Production Machine Co., Greenfield, Mass.
Walls Sales Corp., 96 Warren St., New York, N. Y.

SAW BLADES, HACK

Armstrong-Blum Mfg. Co., 5743 Bloomington Ave., Chicago.
Disston, Henry, & Sons, Inc., Philadelphia, Pa.
Starrett, L. S. Co., Athol, Mass.

SAW FRAMES, HACK

Disston, Henry, & Sons, Inc., Philadelphia, Pa.

SAWING MACHINES, CIRCULAR

Armstrong-Blum Mfg. Co., 5743 Bloomington Ave., Chicago

SAWING MACHINES, FRICTION

Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago

SAWING MACHINES, METAL CUTTING BAND

Armstrong-Blum Mfg. Co., 5743 Bloomington Ave., Chicago.
Continental Machine Specialties, Inc., Minneapolis, Minn.
Racine Tool & Mch. Co., 1752 State St., Racine, Wis.

SAWING MACHINES, POWER HACK

Armstrong-Blum Mfg. Co., 5743 Bloomington Ave., Chicago.
Racine Tool & Mch. Co., 1752 State St., Racine, Wis.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.

SAWS, CIRCULAR METAL CUTTING

Disston, Henry & Sons, Inc., Philadelphia, Pa.
Union Twist Drill Co., Athol, Mass.

SAWS, HOLE

Armstrong-Blum Mfg. Co., 5743 Bloomington Ave., Chicago

SAWS, METAL CUTTING BAND

Disston, Henry & Sons, Inc., Philadelphia, Pa.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.

SAWS, SCREW SLOTTING

Barber-Colman Co., Rockford, Ill.
Starrett, L. S. Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCREW CUTTING TOOLS

See Taps and Dies.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Errington Mechanical Laboratory, 200 Broadway, N. Y.
Haskins, R. G. Co., 4634 Fulton St., Chicago.
Strand, N. A. & Co., 5001 N. Wolcott Ave., Chicago

SCREW MACHINES, AUTOMATIC SINGLE AND MULTIPLE SPINDLE

Brown & Sharpe Mfg. Co., Providence.
Greenlee Bros. & Co., Rockford, Ill.

National Acme Co., Cleveland, O.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.

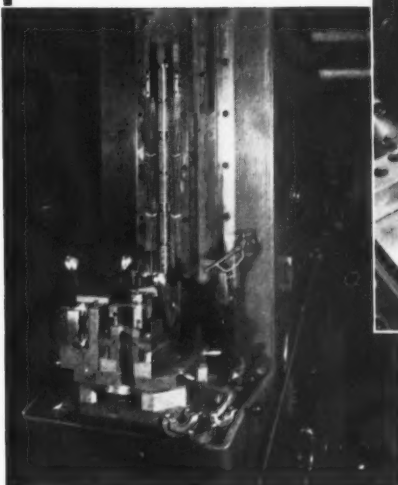
SCREW MACHINES, HAND

See also Lathes, Turret.
Acme Machine Tool Co., Cincinnati.
Brown & Sharpe Mfg. Co., Providence.
Gisholt Mch. Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vt.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston, Mass.
Warner & Swasey Co., Cleveland

SCREW MACHINE TOOLS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence.
Gisholt Mch. Co., Madison, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.
Murchey Mch. & Tool Co., 951 Porter St., Detroit.
National Acme Co., Cleveland, O.

These BROACHING OPERATIONS



TOP ILLUSTRATION: Broaching ends of magnetic coil core. Material is magnetic iron. Necessary to produce extremely high surface finish—free from any burrs after broaching. Fixture manufactured by Detroit Broach Company handles complete automatic cycle from loading in chute to final ejection. Broaches are mounted on removable sub-holders and are adjustable by taper wedges. Production—approximately 3300 pieces per hour.

LOWER ILLUSTRATION: Broaching automobile bearing caps. Three station fixture manufactured by Detroit Broach Company. Two stations broach entire contour. Third station broaches oil seal step. As two stations are of compound design, four entirely different pieces are broached in each cycle.



May Be In No Way Related to YOUR PRODUCTION PROBLEMS

... but they're convincing evidence that the Detroit Broach Company can and does design and produce broaches and broaching fixtures that meet innumerable production requirements. The above illustrations show typical broaches and fixtures designed and manufactured by this company for both high production work and comparatively low production but unusually complicated broaching operations.

When you're thinking of broaches or other broaching equipment to solve any of your particular manufacturing problems, it will pay you to consult the Detroit Broach engineers. They are experienced in handling all types of jobs "from scratch"—and producing the results that mean greater production economy for you.

Your Inquiry Will Receive Prompt Attention

DETROIT BROACH COMPANY

6000 Beniteau Ave. • Detroit, Michigan

- New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Co., Hartford, Conn.
Warner & Swasey Co., Cleveland.
- SCREW MACHINE WORK**
Eastern Mch. Screw Corp., New Haven, Conn.
Link-Belt Co., Chicago.
National Acme Co., Cleveland, O.
New Britain-Gridley Mch. Div. New Britain Mch. Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
- SCREW PLATES**
Besly, Chas. H. & Co., 120-B N. Clinton St., Chicago.
Carl, S. W., Mfg. Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
- SCREWS, CAP, SET, SAFETY SET AND MACHINE**
Allen Mfg. Co., 125 Shelton St., Hartford, Conn.
American Screw Co., Providence, R. I.
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
National Acme Co., Cleveland, O.
National Screw & Mfg. Co., Cleveland, O.
Russell, Burdall & Ward Bolt & Nut Co., Port Chester, New York.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland.
- SEALS AND RETAINERS, OIL OR GREASE**
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago.
- SEAMLESS STEEL TUBING**
See Tubing, Seamless Steel.
- SECOND-HAND MACHINERY, ETC.**
Cincinnati Machinery & Supply Co., Cincinnati.
Cincinnati Planer Co., Cincinnati, O.
Eastern Machinery Co., Cincinnati.
Ganey Machinery Co., Buffalo, N. Y.
Miles Machinery Co., Saginaw, Mich.
Morey Machinery Co., Inc., 410 Broome St., New York, N. Y.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Sun Machinery Co., Inc., Newark, N. J.
Wigglesworth Machinery Co., Cambridge, Mass.
- SEPARATORS, CENTRIFUGAL OIL**
National Acme Co., Cleveland, O.
- SHAFTING, STEEL**
Cumberland Steel Company, Cumberland, Md.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.
Union Drawn Steel Co., Massillon, O.
Union Twist Drill Co., Athol, Mass.
- SHAFTING, STEEL TUBING FOR**
National Tube Co. (U. S. Steel Corp. Sub.), Pittsburgh, Pa.
- SHAFTS, HOLLOW BORED**
American Hollow Boring Co., Erie, Pa.
- SHAFTS, TURNED AND GROUND**
Cumberland Steel Company, Cumberland, Md.
- SHAPERS**
American Tool Wks. Co., Cincinnati, O.
Cincinnati Shaper Co., Cincinnati.
Potter & Johnston Machine Co., Pawtucket, R. I.
Rockford Machine Tool Co., 2412 Kishwaukee Road, Rockford, Ill.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Smith & Mills Co., Cincinnati, O.
Springfield Mch. Tool Co., 631 Southern Ave., Springfield, O.
- SHAPERS, VERTICAL**
Cochrane-Bly Co., Rochester, N. Y.
Hanson-Whitney Mch. Co., Hartford, Conn.
Pratt & Whitney Co., Hartford, Conn.
- SHAPES, STRUCTURAL**
Carnegie-Illinois Steel Corp. (U. S. Steel Corp., Sub.), Pittsburgh, Pa.
- SHEARING MACHINERY**
Armstrong-Blum Mfg. Co., 5743 Bloomington Ave., Chicago.
Cincinnati Shaper Co., Cincinnati.
Consolidated Machine Tool Corporation, Rochester, N. Y.
Morgan Engineering Co., Alliance, O.
Niagara Mch. & Tool Wks., Buffalo.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Union Twist Drill Co., Athol, Mass.
- SHEARS, ROTARY**
Niagara Mch. & Tool Wks., Buffalo.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Union Twist Drill Co., Athol, Mass.
- SHEARS, SQUARING**
Cincinnati Shaper Co., Cincinnati.
Niagara Mch. & Tool Wks., Buffalo.
Schatz Mfg. Co., Poughkeepsie, N. Y.
- SHEAVE WHEELS**
Link-Belt Co., Chicago.
- SHERARDIZING, ELECTRIC**
General Electric Co., Schenectady, N. Y.
- SHEET METALS**
American Sheet & Tin Plate Co. (U. S. Steel Corp., Sub.), Pittsburgh, Pa.
Inland Steel Co., 38 South Dearborn St., Chicago.
Ryerson, Joseph T. & Son, Inc., 2558 West 16th St., Chicago, Ill.
- SHEETS, IRON AND STEEL**
Inland Steel Co., 38 South Dearborn St., Chicago.
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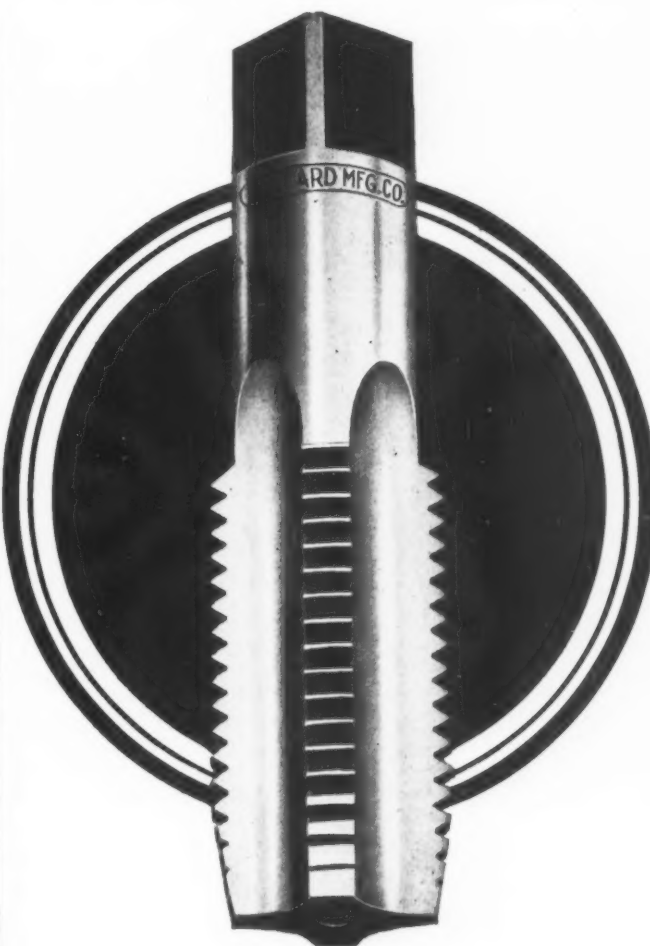
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Standard Pressed Steel Co.	79-84-90
Starrett, L. S., Co.	48
Stokerunit Corp.	81
Strand, N. A., & Co.	85
Strong, Carlisle & Hammond Co.	95
Sundstrand Machine Tool Co.	

Insert bet. 64-69

Sun Oil Co.	55
Superior Die Casting Co.	72

T

Taylor-Shantz, Inc.	76
Tennessee Coal, Iron & Railroad Co.	38
Texas Company	43
Thomson-Gibb Electric Welding Co.	82
Timken Roller Bearing Co.	61
Titeflex Metal Hose Co.	84
Torrington Co.	58-76
Twin Disc Clutch Co.	60

U

Union Carbide & Carbon Corp.	40
Union Drawn Steel Div. Republic Steel Corp.	34-35
Union Twist Drill Co.	22-107
United States Electrical Tool Co.	82
United States Steel Corp. Subsidiaries....	38
U. S. Tool Co., Inc.	77
Universal Boring Machine Co.	78
Used Machinery	94

V

V & O Press Co.	78
Veeder-Root, Inc.	90
Viking Pump Co.	86

W

Walls Sales Corp.	83
Waltham Machine Works	76
Waterbury Steel Ball Co., Inc.	87
Wiedemann Machine Co.	77
Wiesman Mfg. Co.	76

Z

Zeh & Hahnemann Co.	77
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Classified and Re-Sale Section

Cincinnati Machinery & Supply Co.	94
Eastern Machinery Co.	94
Miles Machinery Co.	94
Morey Machinery Co., Inc.	94

